THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1599.] LONDON, JANUARY 2, 1894. [46TH YEAR. PRICE 6d.

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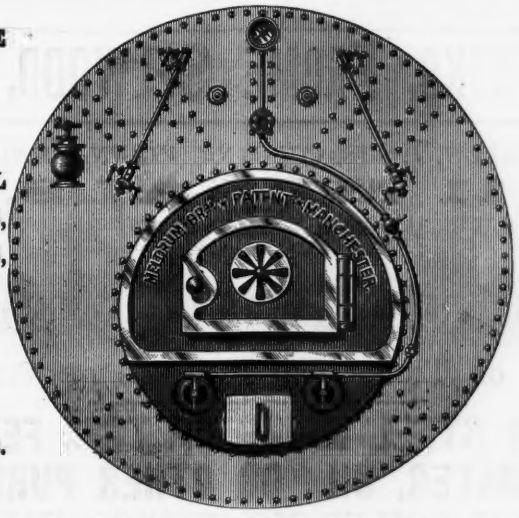

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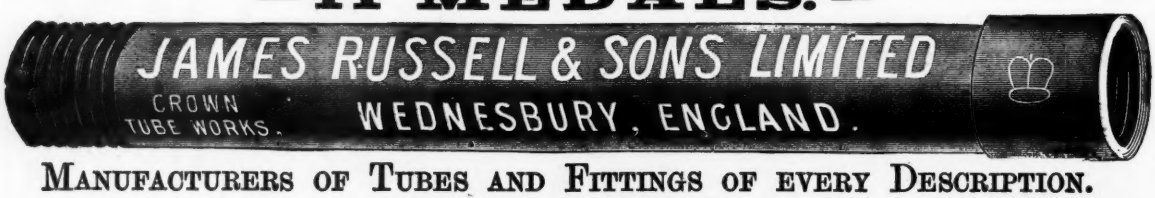

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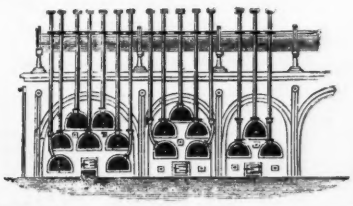

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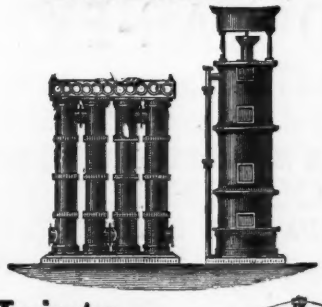

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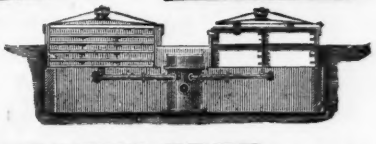

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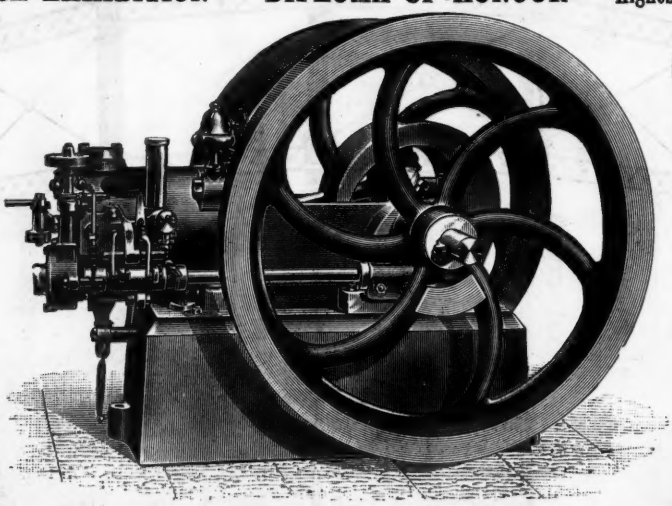

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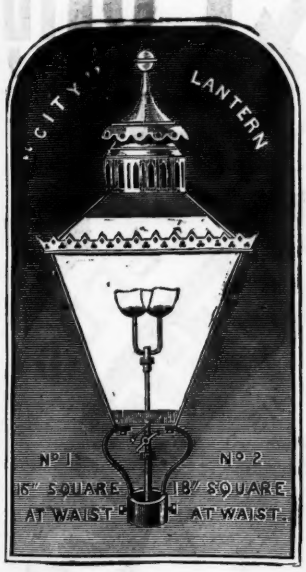

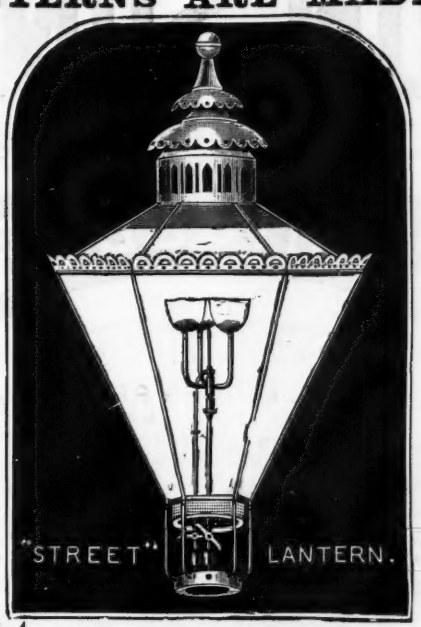

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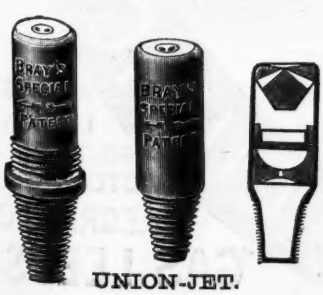

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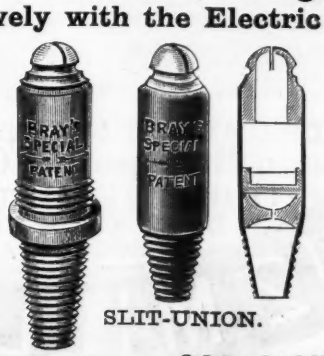

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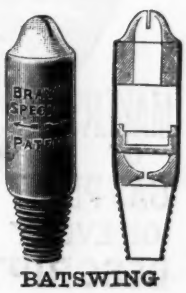

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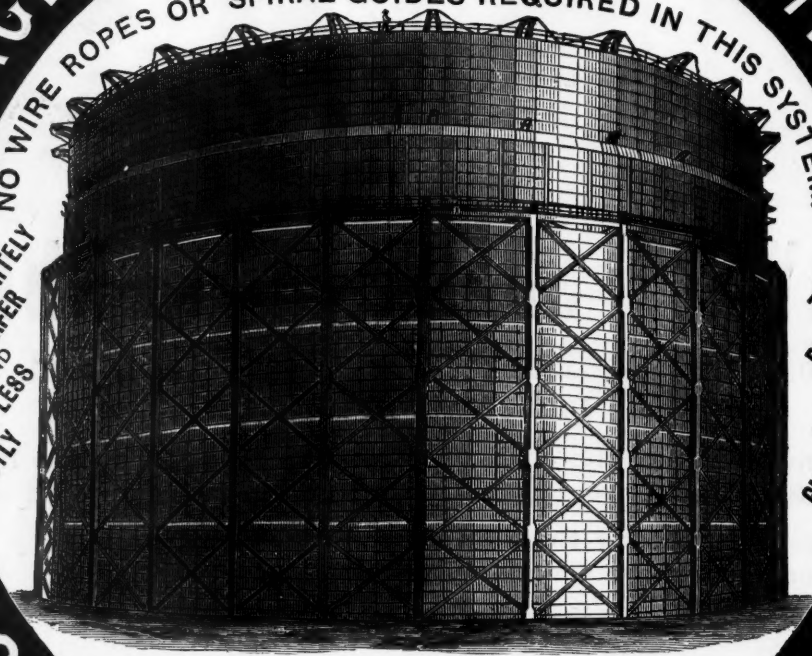

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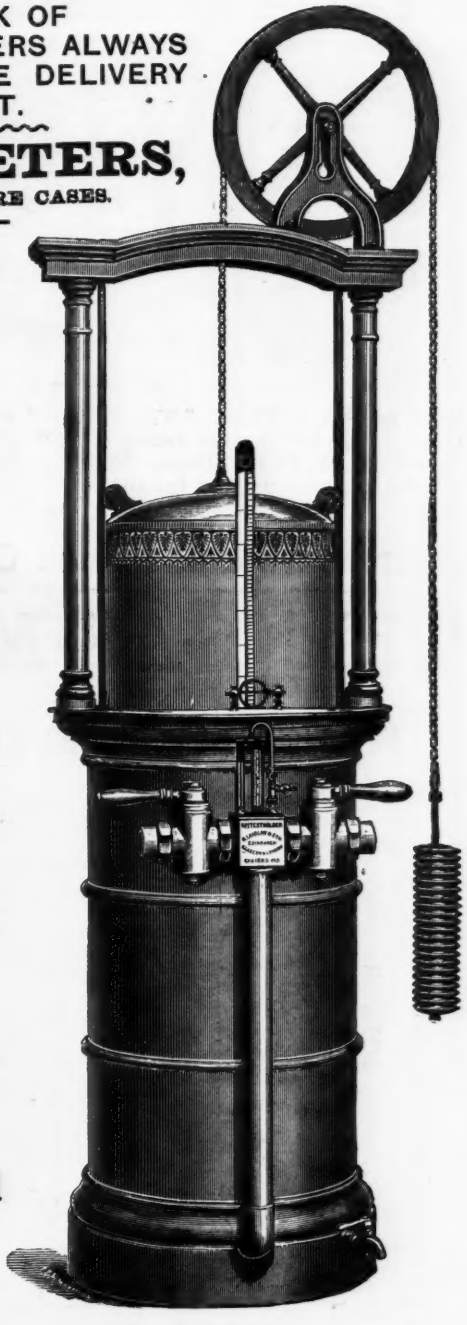

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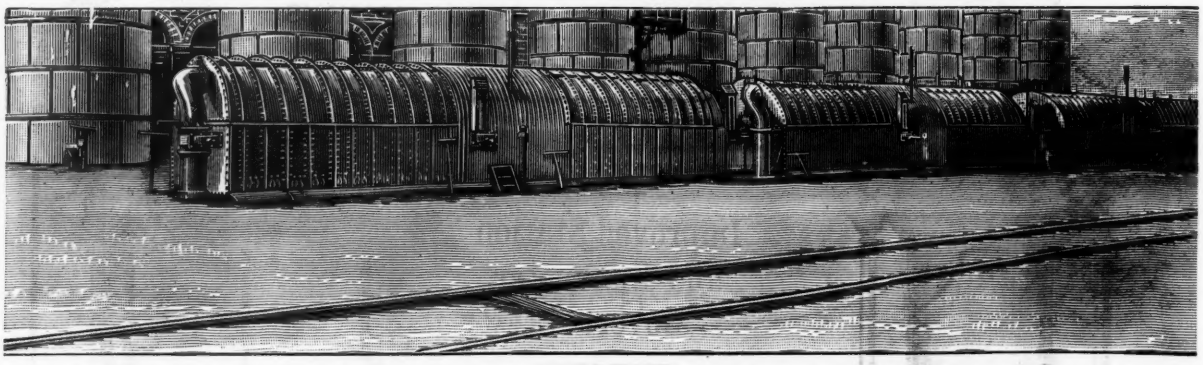

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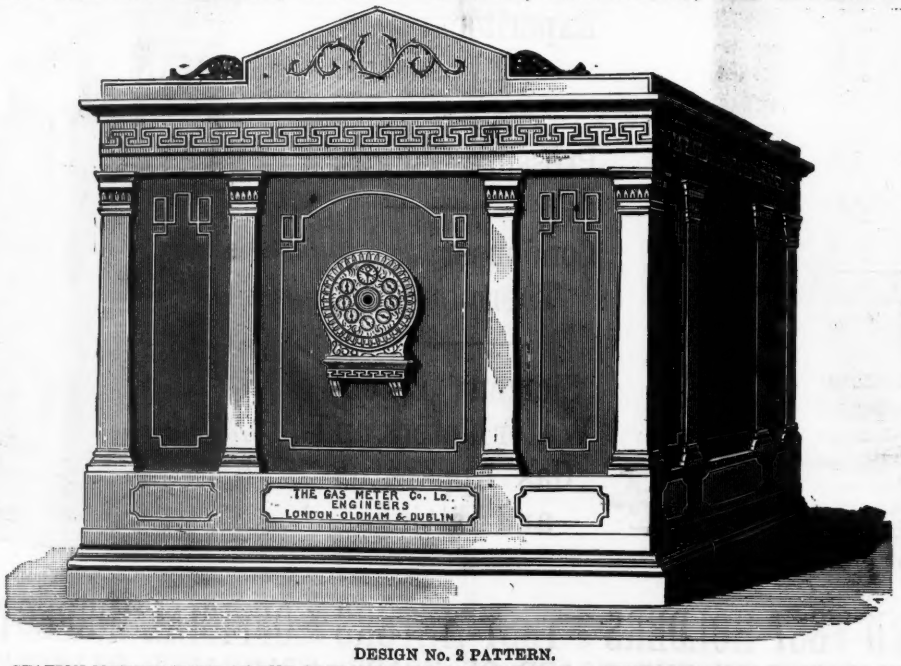

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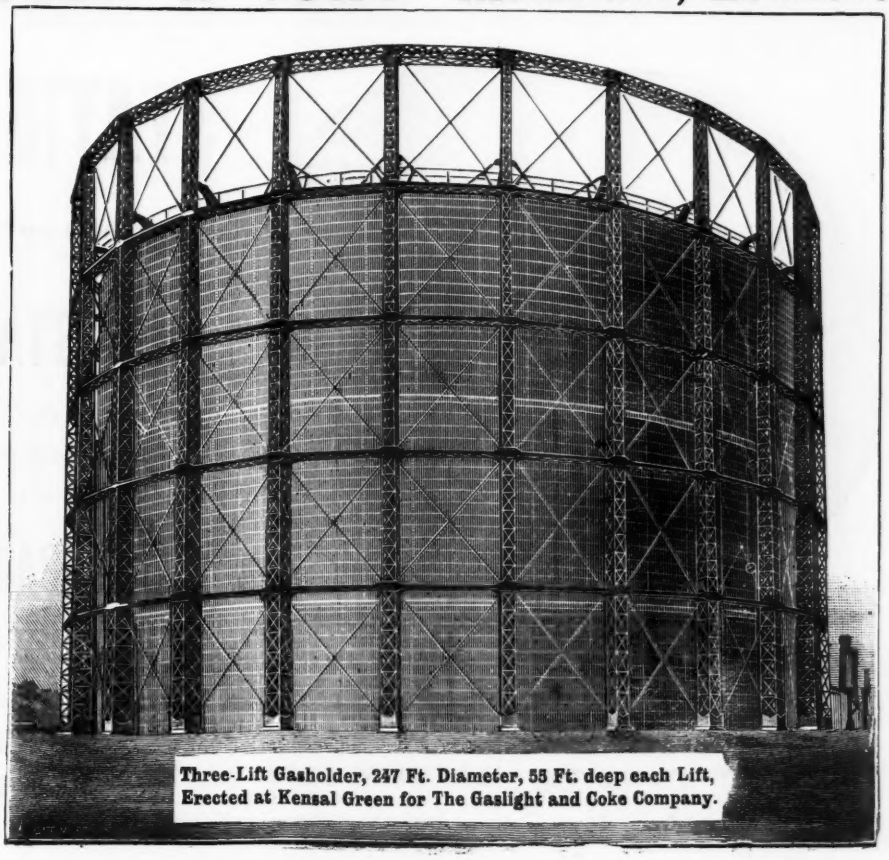

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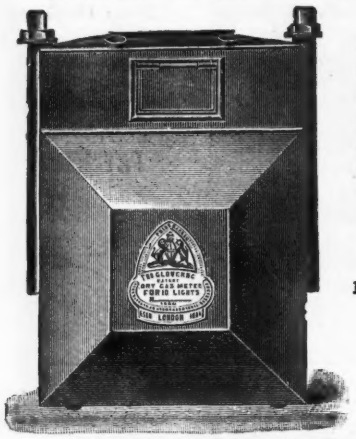

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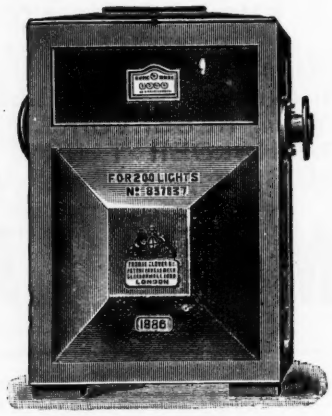

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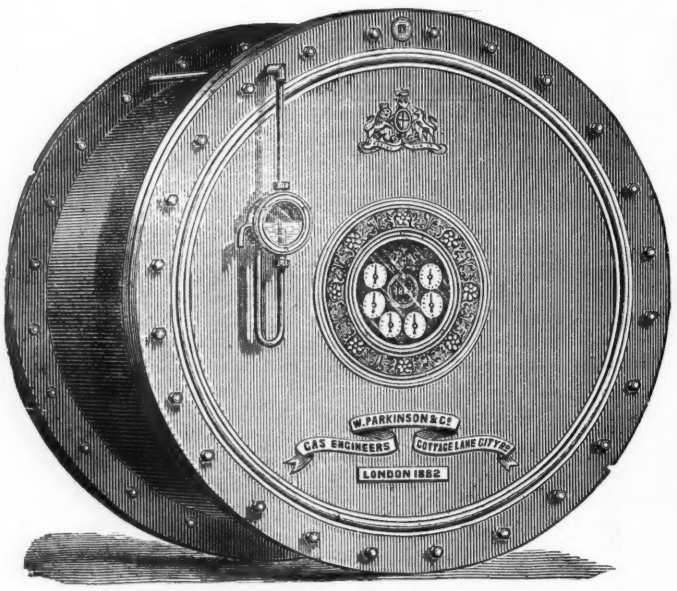

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500 STATION METERS,

Varying in size from **1200** to **250,000** cubic feet per hour, have been sold, fitted with

THREE-PARTITION DRUMS.

DURABILITY UNEQUALLED. SOME HAVE BEEN IN CONSTANT USE FOR OVER 60 YEARS.

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WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 2, 1894.

1893.

A Retrospect of the Year.

IN commencing to marshal for review the events that constitute the material for the chronicle of a whole year—even when these are to be regarded from one particular standpoint—the first impression received by a writer of contemporary history who would be faithful in the performance of his duty, is one of dread lest he should fail in assigning to the multitudinous and diversified occurrences that crowd the record their rightful importance, absolute and comparative. A year of this modern time is to a chronicler both a long and a short period. If he should happen to be optimistically inclined, he will be disposed to magnify his material—seeing progress in every change, and a clear gain in every transaction. If, on the other hand, the historian is by way of being a pessimist, one year will to his view appear very much like another, only rather more disastrous in its occurrences and their consequences. Here again, therefore, the old rule holds good; and the middle course is the safest. The year that has just passed has brought to the world, to every country of the world, and also to every interest and person in every country, a mixed experience. Happily it is not for us to sort out events into different categories of good, bad, and indifferent. We can but recount them, or some of them, as they appear to have happened; and the reader must supply most of the commentary from his own store of impressions.

Generally speaking, the past year would be voted by the majority of the business men of the United Kingdom a period of bad trade. The accumulation of capital by the country has not increased as fast as usual; and there have been several heavy losses of invested capital, which were not only bad for the immediate sufferers, but had the further effect of checking trading operations in many directions. It should be a highly interesting problem to publicists to show why the preservation of the peace of the world, which has now been unbroken for a longer period than history can previously show, has redounded so little in favour of the general welfare. There has not been a great European war for many years; but the peoples have never ceased from fighting and suffering, albeit the weapons employed in this strife are tariffs and monetary symbols. Not only has nation been set against nation, but there have been terrible internecine struggles of class against class, employers against employed, wage-earners against paymasters, producers against consumers. What were the Hull, the South Wales, and the Federation districts labour troubles but warfare, and warfare of a peculiarly deadly and injurious kind? So long as these evils exist, and come into painful prominence, it is vanity to talk of prosperity of trade.

The year has been remarkable in English annals for fine weather. An unprecedented amount of sunshine has been enjoyed over the whole country; and the most immediate consequence of this exceptional meteorological condition with which we have to concern ourselves here is that experienced by the gas industry. There has been hardly any increase of gas consumption anywhere; and accordingly revenue returns of gas undertakings have not exhibited that elasticity which is usually expected of them. Gas stocks, regarded as investments, materially strengthened during the year just closed, notwithstanding every adverse influence that was brought to bear upon them; and never have undertakings of good repute been able to obtain capital so cheaply as they can now. There is not the smallest doubt that if the movement in favour of the consolidation of gas stocks—of which the proceedings of the Crystal Palace District Gas Company under their new Act furnished the most conspicuous illustration for the year—could only be extended, the effect upon the investment market would be of the happiest. To take the example already mentioned in proof of this assertion, whereas at the beginning of the year Crystal Palace District Gas 10 per cent. stock was quoted in our columns as yielding a return after the rate of £5 5s. 3d. per cent., the last quotation gave it as returning only £4 15s. 3d. per cent. An almost equally remarkable fact, but of a slightly different order, is the value of the debenture stocks of the leading Gas Companies. With these evidences of the estimation in which it is held in the Money Market, the financial aspect of the gas industry of Great Britain may be left to speak for itself.

Yet the industry has had its troubles, in connection with money matters, during the year—needing to be dealt with warily, and even so not to be escaped from without sacrifice. Coal contracts, entered into with colliery proprietors in the English districts covered by the Miners' Federation, had to be supplemented during the last quarter of the year at a considerable advance of prices;

and meanwhile coke did not always command a commensurate value. Fortunately the market for sulphate of ammonia commenced to mend for producers early in the year. By Lady-day there was an advance of at least £2 per ton upon January prices; and another £2 rise was secured during the autumn. It is a long time since sulphate commanded such a price as the highest which our detailed summary will mark as having ruled during the past year. Tar also improved in value considerably, but not at such an early period of the year. The curious result followed from these conflicting influences, that while in certain towns the price of gas was raised, in others it was actually reduced. The effect was significant of the chaotic circumstances to which it was due. In the year 1892, there was a suspension of the output of coal from Durham, which caused the London and South of England Gas Companies generally to procure coal at ransom prices from elsewhere. They were unable to recoup themselves for this extra outlay by raising the price of coke, because the Midland towns were then able to swamp their market. Last year the "return match" was played; and while the Midland centres were paying fancy prices for Durham and Welsh coals, coke made from these same coals, bought at contract prices, was available to keep down the revenue for the chief residual of gas manufacture.

This last consideration leads up to the record of the year in the matter of coal miners' strikes, which for many people constituted its principal claim to remembrance. There were notable strikes of miners in South Wales and the South of Scotland; but the great strike and lock-out of the year was that which paralyzed the coal trade of Lancashire, Yorkshire, and the Midlands for the unprecedented period of seventeen weeks in the latter part of the summer and throughout the autumn. Strictly speaking, these disturbances of the coal trade ought to be considered together with the Durham miners' strike of 1892; for they were all due to the same cause—the organization, and the imperfect organization, of the miners in their different Trade Unions. If there had been no organization, there would have been no strikes; if the organization had been better, again there would have been no strikes. As it is, the miners were organized sufficiently to do a great deal of mischief, and stop the coal trade of the country in one district after another; but they could not act all together, and so make their union effectual. When in 1892 the miners of Durham struck, the Scottish miners and the men of the Federation districts of England, and the Welshmen, continued at work. When last autumn the Federation men were idle, the Durham miners were at work; and when still later the Scotch miners tried a strike, all the other coal-fields of the country were in full operation. Thus the whole story of the recent troubles in the coal trade is a tale of division no less than of union; and the saddest part of it is that, while the pitmen bore the brunt of every one of these industrial conflicts, the spoils fell in every case to the middlemen in the trade and to the Trade Union agitators—in other words, to the least deserving of all the different orders of men interested in the coal industry of the country. The whole thing was a most lamentable illustration of the dangerous nature of the disunited Trade Unionism which actually rules the industry. If the Durham, South Wales, Federation districts, and South of Scotland strikes (all occurring within a few months of one another) had been simultaneous, the consequences would have been very different.

The miners' strikes, together with that of the Hull dockers, which occurred in the early part of the year, were as much protests against orthodox political economy as they were claims for higher or revolts against lower wages. They were all managed by professional agitators who had acquired from German theorists hare-brained notions in regard to Sociology. The strike of the Hull dockers was for the old craze of the "recognition of the principle of "Trade Unionism"—meaning the binding of industry hand and foot in fetters forged by demagogues. The strike of the federated miners was in the beginning against a proposed reduction of wages. It eventually became a campaign for what was termed a "living wage," meaning that wages, upon a scale determined by the wage-earners, should constitute a first charge upon the cost of coal production. In its course, this industrial controversy was marked by many interesting incidents, and was terminated by agreement of both parties under the leadership of the Earl of Rosebery. The later Scotch strike was a *fiasco*; but it supplied another example of the pernicious influence of the one-sided, localized kind of trade organization that is actually the greatest plague of the coal industry, as well as of many others.

The spectacle of the chaotic condition of the coal-mining industry, in which a precious national possession is being got rid of to the discordant accompaniment of perpetually-recurring jars and conflicts between employers and employed, while the middleman plunders both them and the consumer, is ample justification for the interest that was displayed during the past year in a scheme for a National Coal Trust, propounded by Sir George Elliot, who died at Christmastide while his great idea remained only in the paper stage of existence. In this scheme, which was fully described and discussed in the JOURNAL at the time of its appearance, the interests of coal owners, colliery proprietors, miners, and consumers were to be combined; and it only wanted a sort of sliding scale (turning it to the advantage of the trade to market coal at the lowest possible figure) to make it a very plausible project indeed. It remains to be seen whether the scheme, or anything like it, will ever come into operation. As an alternative proposal, a Bill has been submitted to Parliament by a group of private members for the nationalization of the coal supply; but this suggestion is not worthy of the name of a scheme, inasmuch as it is quite formless and vague. These signs of the times are worth mentioning, however, as indicating the existence in the community of a sentiment of impatience with the methods by which the coal industry of the country has hitherto been regulated.

The Royal Commission on Labour has been in session throughout the year, and has produced several fruits of its inquiries, consisting of reports of evidence taken from various trades and occupations, including that of gas manufacture, and a number of volumes of foreign reports. Meanwhile, the general questions of labour and wages, and other points of industrial and social economy, have been discussed and ventilated in a way that makes the past year memorable on this account. A new Employers' Liability Bill, abolishing the legal doctrine of common employment, has been introduced into Parliament by the Home Secretary, and has given rise to much controversy, as well as to a conflict between the two Houses. The Bill is practically a product of militant Trade Unionism; and its most controversial feature is its opposition to contracts between employers and employed providing for compensation, out of mutual insurance funds, for injuries received in the course of the employment. The peculiarity of our being able to refer to this measure in the present tense grows out of the unusual circumstance of Parliament being still in session as these lines are written. Other topics in connection with the Labour Question which came under public notice during the year were the formation of the Federation of Free Labourers, which is a counter-movement to the New Trade Unionism. The latter cause suffered considerable discredit through newspaper exposures of the management of the Seamen and Firemen's Union, whose Secretary (Mr. J. H. Wilson, M.P.) vainly attempted to rehabilitate himself by means of libel actions, which failed, and he was adjudged a bankrupt in respect of his inability to discharge the consequent law costs. The bankruptcy has, however, since been annulled, on the debs being paid in full.

Photometrical questions greatly troubled the Metropolitan Gas Companies during the year. The Board of Trade Committee on the Standard of Light for use in testing London gas sat throughout the year, but without arriving at a solution of the difficulty. Meanwhile, some commotion was caused by the action of the London County Council in issuing, to some of the testing-stations under their control, candles of quite a different make from those usually employed, which were alleged to give more light for the weight of sperm consumed than the candles which the Gas Companies had become accustomed to regard as normal. Certain alleged deficiencies of illuminating power, as determined with reference to the new candles, were reported to the Chief Gas Examiner, and by him disallowed, on the ground that the candles were not "prescribed" by the Metropolitan Gas Referees. This authority had never prescribed candles. Upon request, however, they proceeded to do so; and only a fortnight ago we published the official specification for the manufacture of parliamentary standard candles. Some legal

proceedings taken against the Lea Bridge Gas Company early in the year illustrated the obligation that lies upon statutory Gas Companies to provide and maintain efficient testing apparatus.

The most important private Gas Act added to the statute-book for the year was that of the Crystal Palace District Gas Company, already briefly alluded to. This Act extended the principle previously applied to the case of the Bristol United Gas Company, of consolidating gas stock, and reducing the standard rate of dividend payable upon it under the sliding scale to a uniform 5 per cent., which more nearly corresponds to the return actually received by investors in this class of stock than the traditional 10 per cent. This latter rate of dividend has become an anachronism in regard to first-class, old-established gas undertakings; and the movement for abolishing it may be expected to increase in strength and range as opportunity offers. The bases of sulphur testing were also altered by the Crystal Palace Act; and it imposed a proper check upon the London County Council, who had attempted to extend their powers for gas examination to the Suburban Gas Companies. The tendency of local authorities to acquire gas undertakings showed a marked revival last year; transfer Acts being passed in the cases of Barry and Cadoxton, Pontypridd, Todmorden, and New Swindon. The Stourbridge undertaking was purchased by the Improvement Commissioners, at a price settled by arbitration.

Several rather heavy lawsuits in which Gas Companies were involved came before the Courts last year; but none entailed any novel principle, or established a notable precedent. The South Metropolitan Gas Company were cast in damages for injury to house property in the vicinity of their sulphate works. A claim for polluting a stream by drainage from a tar-well was decided in favour of the Bromley Company. An irritating prosecution of the Sunderland Gas Company by the Excise authorities, with the object of rendering sulphate stills dutiable, was defeated by help of the Sulphate of Ammonia Manufacturers' Association. The Hastings and St. Leonards Gas Company had to pay for setting fire to a factory by a leak at a meter. There were also a number of assessment appeals settled in different parts of the country. The activity of the London County Council in the matter of gas testing gave the Metropolitan Magistrates a good deal of work during the year. Indeed, for several years past this class of business has greatly occupied the attention of the officials responsible for the maintenance of the quality of the gas supplied in the Metropolitan area.

Nothing conspicuously fresh in the way of gas-making processes, appliances, or methods signalized the past year; but there was very marked activity in the development of improvements on recognized lines. The quieting down of the Trades Unions affecting gas workers and general labourers has not been allowed to interrupt the progress of the substitution of machine for hand labour in gas making. In the able hands of Mr. John West, stoking mechanism has steadily improved in action and been enlarged in scope; and Messrs. Foulis and Arrol's new hydraulic retort drawing and charging machines made good headway. The application of mechanical conveyors, elevators, and stackers, for handling coal, coke, lime, and other materials in use in gas-works, has received a great impetus of late. Probably more capital was sunk last year in the gas-works of the United Kingdom in this class of appliances than was ever spent upon such an object before. The system of inclined retorts was not neglected, although it has not made itself so generally popular as its partisans at one time hoped. Quite recently, however, we have been able to furnish a very satisfactory account of inclined retort working at Brentford, which may give the system a fresh start. An interesting contribution towards the solution of the problem of mechanical coal carbonizing was the Yeadon "revolving" retort. The subject of gas carburetting by cannel substitutes attracted much attention during the year, mainly as a result of the success of the Young and Bell oil-gas process, round which quite a literature has sprung up. The revival at Huddersfield of the Tatham process for preparing a mixture of oxygen and oil gases, as a means of enriching common coal gas, has been a source of somewhat embittered controversy; and our own reluctance to concede the claims of the partisans of this process has been visited by the institution of an action for "libel." We take this opportunity of thanking all those who, on this circumstance being made known, kindly came to the support of the JOURNAL with offers of expert and other forms of assistance, which were specially grateful as evidence of the reasonableness of our attitude in this matter. With the exception of Beckton and one or two other large works reported to be putting up trial plant, it does not appear that water-gas processes materially improved their position in British gas undertakings last year. Gas managers still seem undecided whether to judge water gas from the standpoint of carburetting or from that of production. Outside gas-works, the gas apparatus that has made most noise in the technical world is the automatic prepayment meter, in its different modifications. A reference to the "penny-in-the-slot" consumer's meter by Mr. George Livesey, in his address to the summer meeting of the proprietors of the South Metropolitan Gas Company, created quite a *furore* on the subject; and a large trade has been done in these appliances in many parts of the kingdom. If it cannot be accepted as proved that the "penny-in-the-slot" meter fully meets the competition of cheap lighting oils with gas, it may freely be conceded that it and its congeners are certainly potent aids to the popularization of gas among small householders.

The various institutions and technical societies in connection with the gas industry of the United Kingdom have had, on the whole, a successful year. The Belfast meeting of The Incorporated Gas Institute was fairly well attended; and, thanks mainly to the clever Inaugural Address of the President—Mr. Denny Lane—it was creditable to the Institute. The Institution of Gas Engineers justified its existence by holding an interesting meeting in London in May, under the presidency of Mr. J. Methven; but the autumn meeting at Portsmouth was a bare *succès d'estime*. The North British Association did well at Dundee; and the District Associations maintained their position. An effort was made, under the auspices of the members of the South-West of England Association, to bring about a conference with a view to federating the different societies, and so putting an end to the present unhappy division in the ranks of the members of the national industry of gas manufacture; but, for want of a programme, nothing came of the movement. The British Association for the Advancement of Science met in Nottingham, when Professor Smithells lectured on "Flame," and Professor Vivian B. Lewes discoursed to working men on "Spontaneous Combustion." Professor Smithells's lecture is in type, and will appear in an early issue. Interesting and instructive lectures and addresses upon subjects more or less germane to the gas industry were delivered before different scientific bodies, and reported or commented upon in the JOURNAL at the time. With the exception, however, of the experimental solidification of atmospheric air by Professor Dewar—thus demonstrating that the physical state of matter is an effect of temperature and pressure—there was no striking advance to be recorded in respect of physical science.

The tale of accidents and casualties for the year in connection with the gas industry is happily light. Indeed, rarely has so short and slight a list of gas fatalities for a year come under our notice; and not one of them calls for particular mention here. From the legal point of view, the most interesting occurrence coming within this category was the explosion in a street box belonging to the City of London Electric Lighting Company, for which The Gaslight and Coke Company had to pay. This incident, with others, led to the appointment of a Joint Committee of the two Houses of Parliament to deal with the question of damage to gas and water mains by electrolysis and induction from underground electric light wires. From the medical standpoint, the most noteworthy gas fatality was that of the Hampstead gasfitter, who died in February from the effects of gas poisoning in his own home. In this case, the man lingered three days in a state of unconsciousness, and died, nineteen days after he was "gassed," from softening of the brain. We believe this case to be unique. Attention was directed during the year to the general subject of industrial diseases; and the manufacture of white lead was condemned as hopelessly insanitary.

Death took last year several well-known gas engineers gas managers, and professional men of various descriptions, whose names were more or less well known in connection with the gas industry; but here again Fate

has not borne very hardly upon us. Mr. James Paterson, erstwhile of Warrington, was a worthy member of the gas engineering profession in his day, and one whose work was done when he was called away. Mr. S. R. Ogden, of Blackburn, was taken in the midst of his labours; and the same may be said of Mr. W. Duesbury, of Cambridge. Mr. W. Richards was a well-known writer upon gas manufacture, and one of the pioneers of the dry meter. Mr. Layard Jones, of Rome, and Mr. D. A. Graham, of Dunedin, were both a loss to their profession. Science had to mourn the death of Professor Tyndall, whose claims to remembrance do not need to be recounted here; and in the veteran Thomas Hawksley both civil and gas engineering lost a leader. Two well-known chemists who took much interest in gas matters—Professors C. W. Heaton and W. Foster—died at comparatively early age. Among the personal changes, the principal event to be noted is the retirement of Mr. John Orwell Phillips, the famous Secretary and General Manager of The Gaslight and Coke Company, and the last representative of an order of officials to which the British gas industry owes much of its actual standing. He was succeeded by Mr. John W. Field, previously Accountant of the Company. Mr. Magnus Ohren, Secretary of the Crystal Palace District Gas Company, also retired from office, and was succeeded by his son, Mr. Charles M. Ohren. Among the personal events of the year must be recorded the successful establishment of the William Livesey Testimonial Fund, which was a pleasing evidence that the gas industry is not unmindful of its old servants.

Little more remains to be said before this Retrospect is closed. The year ends with the national industry of gas manufacture and supply pretty much where it was at the commencement, and certainly without showing the slightest flaw in its prosperity or check upon its development. And as with the industry, so it is with the JOURNAL which constitutes its standard chronicle and commentary. Gas engineering is a wider and fuller profession to-day than it ever was before, and demands for its proper practice knowledge of many things. To keep abreast of all the intelligence of the passing hour is not an easy matter; but it must be done by all who desire to live fully in the present. It is often remarked that this is an age of specialism in literature and journalism as in other things; but, so far as the JOURNAL is concerned, its specialism began long ago—almost half-a-century. This is the oldest of all technical periodicals published in the United Kingdom; and it aims at being also among the freshest, strongest, and fullest of its class. The JOURNAL grows with the industry which it represents, and goes with it into all parts of the world; having, indeed, few equals in respect of wide circulation. We hope and intend to maintain in the future the quality which has earned for us this distinction. Whatever its rivals may pretend, gas is as likely to be the light of the future as it is of the present, and has been of the better part of the century; and the JOURNAL shall be the light of the gas industry henceforward as it has been "lang syne."

The Management of the Newtownards Gas-Works.—We learn that the vacancy caused in the managership of the Newtownards Gas-Works by the removal of Mr. A. Waddell to Broughty Ferry has been filled by the appointment of Mr. John Dewar, eldest son of Mr. D. Dewar, Chief Constable of Dundee. Mr. Dewar was for four years with Mr. J. M'Crae, at the Dundee Gas-Works; and he was subsequently assistant to Mr. G. R. Hislop, at Paisley. He is quite a young man—being only 23 years of age—but one of great promise.

Death of Sir G. Berkley.—The death of Sir George Berkley, K.C.M.G., the eminent civil engineer and Past-President of the Institution of Civil Engineers, which took place suddenly on the 20th ult., in his 73rd year, calls for notice in our columns from the fact that, although the deceased was chiefly known in connection with railway work, he was occasionally engaged in other branches of engineering. Among other commissions accepted by him was one in 1850 to thoroughly examine, in conjunction with Mr. Phipps, on behalf of Mr. Robert Stephenson, the water supply of Liverpool; and later in his career he carried out several water and other works in India. He became an associate of the Institution in 1845, and a member in 1854. In due course he was elected on the Council, and held the presidency in 1891-2. He was also one of the Board of Managers of the Royal Institution. The honour of knighthood of the Order of St. Michael and St. George was conferred upon him on the Queen's last birthday, "for services rendered as Consulting Engineer to the Government of Natal, and in connection with other colonies."

WATER AND SANITARY AFFAIRS.

DURING the year which has just closed, the question of the Metropolitan Water Supply has attracted an amount of attention only surpassed by that which was excited in 1880, when the Purchase Bill introduced by the present Lord Cross came under discussion. The Royal Commission entrusted with an inquiry of especial importance into the sufficiency and purity of the existing supply of water to the Metropolis, and its adequacy for coming years, commenced its public sittings in May, 1892; and the end of that year found the inquiry still incomplete. Early in 1893, the Commissioners resumed the reception of oral evidence; and at Midsummer they held their final sitting, so far as their public proceedings were concerned. It was not until the middle of September that the report of the Commission was laid on the table of the House of Commons; but it cannot be said that too great an amount of time was thus expended in arriving at a conclusion on a subject of so much moment. It had been asserted by the London County Council that the Metropolis was in danger of outgrowing the resources at the command of the Water Companies; and it was urged that no time should be lost in seeking a more abundant supply, to be derived from some distant and sparsely-inhabited spot. An expenditure of many millions of pounds was thus in prospect, coupled with an enormous sacrifice of capital invested in the Companies' works. The Royal Commission was itself the outcome of an agitation which had been diligently fostered by the County Council. But the result of the inquiry was eminently satisfactory from a public point of view, both as to the amplitude of the sources from which the supply was derived, and as to the purity of the water when it reached the consumer. Neither was there any proof that the Companies had failed in the efficient discharge of their responsibilities as the purveyors of water to the Metropolis. Through the rigorous ordeal of the Commission, the Companies passed unscathed; and they found their position more secure than it had been for many years. Pending the completion of the inquiry, the Companies had in a great measure abstained from entering on a large outlay for the extension of their works. The East London Company did, indeed, venture to promote a Bill during the past session, for the purpose of raising capital wherewith to enlarge their reservoirs and extend their mains. But the tactics of the County Council prevailed to such an extent that Parliament was hoodwinked into the rejection of the measure on the motion for the second reading. Had a reference to a Select Committee been permitted, there is every reason to believe that the merits of the Bill would have been so apparent as to have gained for it the sanction of the Legislature. The report of the Royal Commission has now altered the aspect of affairs, and the East London Company have deposited a Bill for the ensuing session, providing for the execution of works in accordance with the Commissioners' views. The Southwark and Vauxhall Company are adopting a similar policy, and are prepared with a Bill for the construction of extensive storeage works on the banks of the Thames above London. If both Bills should pass, an immense step will be taken towards meeting the demands of that greatly increased population which is expected to occupy the watersheds of the Thames and the Lea in future years. But beyond this, as recently explained in our columns, there is the great probability of combined action on the part of the Companies connected with the Thames, so as to secure the total supply of 300 million gallons per day from that source, by the time the population require it—no damage in the meantime accruing to the river.

Notwithstanding the report of the Royal Commission and the movement on the part of the London Water Companies, the County Council have seen fit to prepare a Bill by which they are to be authorized to purchase lands, water rights, water-works, and other properties, "with a view to the future supply of water for London "and the neighbourhood." Another incident in connection with the London Water Supply, and one which is likely to have far-reaching influence, has arisen out of the General Powers Bill of the County Council, as promoted in the past session of Parliament. Over this Bill there was some contention between the Lords and the Commons, settled at last by a compromise by which the Council obtained the power of representation on the

Thames Conservancy Board to the extent of three members. The admission of a representative from each of the four riparian counties of the Lower Navigation was also provided for. In the month of October, the London County Council elected as their representatives Mr. C. Harrison, Mr. Bassett Hopkins, and Mr. J. M'Dougall. But the more important element was a clause in the General Powers Bill, requiring that the constitution of the Thames Conservancy Board should be further altered within three years. It was thus provided that a Bill for this purpose should be introduced by the Thames Conservators in 1894, or else by the County Council in 1895. In accordance with this enactment, the Conservators have deposited a Bill proposing some important changes in the constitution and powers of that body. From the commencement of 1895, the twenty-nine Conservators would include five representatives of the London County Council, and five appointed by the Corporation—these two bodies being thus put on a level. No place is found for the Water Companies; but the eight County Councils along the course of the river, independently of the London authority, are to appoint one member each. The Admiralty, the Board of Trade, and the Trinity House are each to appoint two. The remaining five are to be elected by shipowners and others. For the prevention of pollution to the stream, the authority of the Conservators is to extend over the whole length of the tributaries, instead of being limited to a distance of ten miles from the main stream as heretofore. The contributions of the Companies are to be increased from their present aggregate of rather less than £18,000, to a total of £29,750, but without any enlargement of the authorized quantity of water. The Bill also stipulates that any water taken off, out of, or from under any land within 500 yards of the Thames shall be considered as taken from the river itself. A power of inter-sale between the Companies is to be granted, so that the water which is not required by one may assist another.

Legislation on the subject of the water supply during the past year has not presented any remarkable features; the authorized schemes being of an ordinary character. Only two new Companies were incorporated by Act of Parliament in the recent session; one being for the Frimley and Farnborough district, in Hampshire and Surrey, and the other for Christchurch and contiguous parishes in West Hampshire. Some of the extension schemes were rather large. The South Staffordshire Water Company were authorized to raise £150,000 of further capital, and to construct additional works. The Belfast Water Commissioners obtained power to borrow £875,000 for new works. In Dublin, the Corporation were authorized to borrow for water purposes an additional sum of £120,000. At Plymouth, the Corporation were empowered to enlarge their water-works, and to borrow for this purpose £150,000. Other localities might be mentioned as affording similar instances in respect to Companies or Local Authorities. But in no case was any great watershed appropriated, such as might excite the apprehensions of the London County Council, fearful that they may be prevented from starting a scheme to bring in a supply from some distant source. Neither is there anything on a large scale proposed for the coming session, except in the case of the East London and the Southwark and Vauxhall Water Companies. Whether the vague though comprehensive Water Bill of the London County Council is likely to lead to any great enterprise—supposing the Bill to pass—is a possibility of a very uncertain character. The Bill is rather to be looked upon as a menace to the London Water Companies, virtually taking the place of the recommendation put forth by one of the Committees of the Council in May last, urging that a Bill should be brought forward for the purpose of introducing an independent water supply into the Metropolis. The recommendation was withdrawn in the course of three weeks; the prospect of success being evidently too remote. That extensive watersheds have been taken by large towns, who have thus sought a supply from a distance, is undeniable—as in the case of Manchester, Liverpool, and Birmingham; and the value of such natural resources has become more highly appreciated. But the Metropolis has sufficient resources near at hand; and there is no need for the County Council to frame a Water Bill by which they may roam all over Great Britain.

The advantage possessed by London, in procuring its supply from the watersheds of the Thames and the Lea, has been remarkably illustrated during the past year. The drought of 1893 was certainly extraordinary; and the sources of urban water supply have been sorely tried. Short allowance has been given to the consumers in several instances, in order to avoid the actual emptying of the reservoirs. Fed by the flowing streams of the Thames and the Lea, aided by the deep wells, the water supply of the Metropolis has experienced no restriction; and the spread of the constant service has gone on with unabated rapidity. On this latter point, we have recently observed that if the present pace is maintained, the constant supply will be general throughout London in the course of a very few years. The effect of the drought at Newcastle and Gateshead has been to raise a discussion in the Newcastle City Council as to the desirability of bringing a supply into the Tyne Valley from Ulleswater. At Liverpool a very different aspect of affairs presents itself; the supply having been abundant all through the drought.

Science continues to throw its welcome light on the subject of water purification. The power of the filter-beds as connected with the water supply of a town is now capable of being measured, not merely with reference to chemical ingredients, but in regard to the active and living agents of disease. Professor Percy Frankland has stated that, if storeage and filtration are properly carried out, the bacilli "have little chance;" though without such precautions they may prove dangerous. The cholera at Hamburg afforded striking evidence on this point. Altona, a suburb of the city, takes its water supply from the Elbe, as does Hamburg, but with this difference—that Altona derives its water from a worse part of the river than Hamburg, only it has the benefit of sand filtration for the water which it takes, whereas Hamburg uses the water without filtration. Under these circumstances, the cholera statistics show a decided preponderance in favour of Altona. In 1885, Professor Percy Frankland found that, on an average, 98 per cent. of the bacterial organisms were removed from the London water by the filtration processes adopted by the Companies. Since then the proportion has run still higher; and in the last monthly report by Dr. Edward Frankland, the supply furnished by the East London Company is stated to show a reduction of 99·98 per cent. in the number of bacteria as compared with the water of the river. Similar precautions to those adopted in the Metropolis, if extended throughout the kingdom, could not fail to have a marked effect on the public health in those cases where a polluted supply is actually given. Much valuable information on the vitality of bacilli and their spores is contained in the second report to the Water Research Committee of the Royal Society, by Professor Percy Frankland and Professor Marshall Ward. An important fact is embodied in a single sentence of the report, where it is said: "Hitherto no pathogenic bacteria "have been found in the Thames water, either by other "observers or ourselves."

The purity of the water supply is a subject generally connected more or less with the drainage of towns and the treatment of sewage. The discharge from the great outfall sewers at Barking and Crossness has no bearing on the quality of the London Water Supply; but it is encouraging to know that the chemical process carried out by Mr. W. J. Dibdin, the Chemist to the London County Council, aided by the removal of the sludge out to sea in ships devised for the purpose, has brought about a most satisfactory change in the condition of the stream. Some interesting experiments, relative to the action of the microbes, are now in progress at the Barking outfall, involving the use of filter-beds. Attention has been lately called to the purification of sewage by means of electrolyzed sea-water, as practised at Lorient, on the French coast, by the inventor of the process, M. Hermite. The foulest sewage is stated to become speedily transformed, under this treatment, into a liquid entirely free from colour or odour. The microbes, also, are all killed. But there are sundry experts who look upon this latter result as undesirable; some of the organisms being very useful as scavengers. That electricity can be so applied as to purify sewage, was shown some time ago by Mr. William Webster, son of the late well-known contractor, whose name is associated with the Victoria Embankment and some other important works in the Metropolis. Mr. Webster's process is understood to be effectual; but local authorities are apparently unwilling to pay the price.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 35.)

THE small portion of the last week of the year which was available for business was naturally quiet. Commencing as it did on Wednesday, after the long Christmas interval, and with the prospect of another closure on New Year's Day, the settlement alone saved it from almost absolute inactivity. For lack of support, the general tendency was thus towards depression; and this was accentuated by the extreme weakness of the American, and also some flatness in the Foreign market, though the closing prices were not the worst of the week. The high-class securities again formed an exception to the general course of prices. The Money Market was easy, and would have been easier but for the settlement causing a moderate demand. The Gas Market has shared in the prevailing quietude; but it did not exhibit any tendency to droop for want of support—what slight changes of price have occurred being in the upward direction. Gaslight "A" took the lead; opening at 227½, and steadily improving until it closed at 232. Hardly anything was done in the secured issues. The other two Metropolitan Companies were inactive and unchanged. Among the Suburbans and Provincials, nothing was touched but Brentford, which changed hands at good figures. Of the Continentals, Union again was in good favour; but Imperial showed no disposition to recover. None of the rest made any sign. Water stocks were much neglected; but prices held firm generally, while Southwark ordinary rose slightly.

The daily operations were too slight to call for detailed notice. On Wednesday and Thursday everything was excessively quiet and unchanged; but on Friday improvements started with a rise of 1⅛ in Gaslight "A," and a similar advance in Southwark ordinary. On Saturday, the improvement in Gaslight "A" was supplemented by a further gain of 1.

In accordance with our usual practice, we append a comparative table of the quotations of Gas and Water securities at the close of 1893, and as they were twelve months previously—showing their respective gains and losses. The latter are comparatively few and slight, and are almost wholly confined to Foreign undertakings; and nearly all are attributable to the special influence of local monetary disturbances, which it is to be hoped will be allayed in course of time. The gains are large and extensive; and the Metropolitan and Suburban Gas Companies are very conspicuous among the gainers. Their debenture and preference issues have been specially aided by the strong and continuous demand for high-class securities. The Water Companies show an unbroken rank of advances, though widely differing in extent; those stocks which were the most depressed this time last year having naturally the longest scope for recovery.

NAME.	Prices on Dec. 31, 1892.		Prices on Dec. 31 1893.		Gain or Loss.
GAS COMPANIES.					
Alliance and Dublin Company, 10 per cent. maximum	16—17	..	16—17	..	—
Do. 7 per cent.	11—12	..	11½—12½	..	+½
Australian (Sydney) 5 per cent. Debentures	105—107	..	106—108	..	+1
Bahia, Limited	11—12	..	10—11	..	−1
Bombay, Limited	5⅞—6⅛	..	5—5⅛	..	−⅞
Do. New	4—4⅛	..	3¾—4¼	..	−¼
Brentford, Consolidated	212—217	..	220—225	..	+8
Do. New	163—168	..	163—168	..	—
Brighton and Hove, Original	40—42	..	41—43	..	+1
Bristol	103—106	..	102—105	..	−1
British	41—43	..	42—44	..	+1
Bromley, ordinary 7 per cent.	14½—15½	..	15—16	..	+½
Buenos Ayres (New), Limited	7⅛—8⅛	..	5⅛—6⅛	..	−2
Do. 6 per cent. Debenture	99—102	..	98—101	..	−1
Cagliari, Limited	25—27	..	27—28	..	+1½
Commercial, Old Stock	232—237	..	244—249	..	+12
Do. New do.	180—185	..	187—192	..	+7
Do. 4½ per cent. Debenture Stock.	120—125	..	125—130	..	+5
Continental Union, Limited	220—225	..	228—233	..	+8
Do. 7 per cent. Preference	187—192	..	195—200	..	+8
Crystal Palace District	185—190*	..	100—105†	..	+15
European, Limited	19½—20½	..	22—23	..	+2½
Do. Partly paid	14—15	..	15—16	..	+1
Gaslight and Coke, A, Ordinary	221—225	..	228—233	..	+7½
Do. B, 4 per cent. maximum	95—98	..	97—102	..	+3
Do. C, D, and E, 10 per cent. Preference	260—265	..	275—280	..	+15
Do. F, 5 per cent. Preference	116—121	..	125—135	..	+11½
Do. G, 7½ per cent. Preference	166—171	..	185—190	..	+19
Do. H, 7 per cent. maximum	161—166	..	173—178	..	+12
Do. J, 10 per cent. Preference	257—262	..	270—275	..	+13
Do. K, 6 per cent. Preference	152—156	..	164—169	..	+12½
Do. 4 per cent. Debenture Stock.	117—120	..	127—130	..	+10
Do. 4½ per cent. Debenture Stock.	122—125	..	130—135	..	+9
Do. 6 per cent. Debenture Stock.	163—168	..	175—180	..	+12
Imperial Continental	219—223	..	210—215	..	−8½
Malta and Mediterranean, Limited	4—4½	..	4½—5	..	+½
Metropolitan of Melbourne 5 per cent. Debenture Stock	107—109	..	106—108	..	−1
Monte Video, Limited	14½—15½	..	12½—13½	..	−2
Oriental, Limited	8—8½	..	6¾—7¼	..	−1¼
Ottoman, Limited	4—4¼	..	4—4¼	..	—
Pará, Limited	2—2⅛	..	1⅛—1⅛	..	−¾
People's Gas of Chicago, 1st Mtg. Bds.	103—107	..	98—102	..	−5
Do. 2nd do.	100—105	..	96—100	..	−4½
San Paulo, Limited	8½—9½	..	8½—9½	..	—
GAS COMPANIES.					
South Metropolitan, A Stock	288—293	..	307—312	..	+19
Do. B do.	235—239	..	243—248	..	+8½
Do. C do.	245—250	..	253—258	..	+8
Do. 5 per cent. Deb. Stk.	140—144	..	148—152	..	+8
Tottenham and Edmonton, Original	225—230	..	215—220	..	−10
WATER COMPANIES.					
Chelsea, Ordinary	245—250	..	265—270	..	+20
East London, Ordinary	202—206	..	208—213	..	+6
Do. 4½ per cent. Debenture Stock	141—144	..	143—148	..	+3
Grand Junction	104—108	..	109—112	..	+4½
Kent	275—280	..	285—290	..	+10
Lambeth, 10 per cent. maximum	217—222	..	235—240	..	+18
Do. 7½ per cent. maximum	189—193	..	196—201	..	+7½
Do. 4 per cent. Debenture Stock	123—128	..	128—131	..	+4
New River, New Shares	325—330	..	345—350	..	+20
Do. 4 per cent. Debenture Stock	132—135	..	132—135	..	—
Southwark and Vauxhall, 10 per cent. max.	148—153	..	155—160	..	+7
Do. 7½ per cent. maximum	135—140	..	144—148	..	+8½
West Middlesex	237—242	..	263—267	..	+25½

* Ten per cent. standard dividend. † Five per cent. standard dividend.

ELECTRIC LIGHTING MEMORANDA.

The State of Electric Lighting During the Past Year.

IN recounting the history of electric lighting for the past year, it is better to begin by acknowledging that this industry has made a certain amount of progress, not only in respect of the number of installations, but also in the conduct of the business of lighting during this period. There are more electric lighting stations at work now than were in existence at this time last year; and some of those that were then working have done fairly well since. It is necessary to discriminate, however, in making this admission. The most conspicuous examples of central station lighting, and especially the large Metropolitan undertakings of this kind, are in pretty much the same case as they were twelve months ago. The best of them have largely increased the number of lamps on circuit, and made some advance in the direction of balancing plant and expenditure to the commercial demand; but none of them has yet attained the goal of the closed capital account. It will perhaps be as well to explain what we mean by this phrase. We do not mean the cessation of all capital expenditure, but the rounding off of the undertaking and its treatment as a settled concern, in which all expenditure properly chargeable to revenue is so charged, and capital is only spent upon extensions. It is now a good many years since the earliest of the central station electric lighting ventures was started; but inasmuch as not one of them has a closed capital account, and charges to revenue the full burdens of management, repairs and maintenance, and depreciation, it is impossible to state what electric lighting really costs.

There has not been anything like the enormous expansion of the electric lighting interest that was expected and foretold by the partisans of the industry. So far from superseding gas, electricity has not succeeded in taking up the ordinary increase of British gas undertakings, even where it has been provided on the largest scale; and although a number of electric lighting ventures have been started by local authorities, they are always on a modest scale. Moreover, the plant of the longest established central stations has not been rendered obsolete by later inventions; and that of the newest is no more perfect or free from the liability to break down than is the oldest. Only upon St. Thomas's Day, a banquet at the Mansion House would have been plunged in darkness had it not been for the faithful gas. Of course, we may be told that this was a small mishap for which the City of London Electric Lighting Company ought not to be blamed. But there is the fact; and while such things are done, it is vain for the electricians to talk about the perfection of their appliances.

Expert opinion in the electric lighting interest appears to have become more settled in regard to the advantages of the direct low-pressure supply and the alternating high-pressure system. It is admitted that the field for the former is very limited, inasmuch as the generating station must be plumped right down in the middle of the district served, if the distribution is to be even passably economical. The range of the alternating system is much wider; and the circumstance that this system does not lend itself readily to power distribution has been seen to be of no moment, since the public will have nothing to do with electric motors at the price of current. On the other hand, a disturbing question as to the durability of the insulated cables used for distributing the high-pressure alternating current has arisen, and has not been answered. "Sufficient for the day" seems to be the motto of the electric light engineer; and the consideration of who is to relay his mains, and when, does not enter into his calculations. Meanwhile, the most celebrated exponent of the high-pressure alternating system of electric supply in England—the London Electric Supply Corporation, whose first Engineer was Mr. Ferranti, and whose generating station at Deptford used to be one of the engineering sights of the town—is still in the lowest of low water.

The development of electric lighting in this country has always been more a matter of the incandescent lamp than of the arc lamp; and the expiration in November of the master-patents of the Edison and Swan Company was looked forward to as the commencement of a new era for the industry. Up

to just before this period, the standard cash price of all lamps of the powers in most general use was 3s. 9d. each; and then the market was flooded with lamps at 1s. and 1s. 6d. It is too early as yet to say definitely what effect the dawn of the era of cheap (and perhaps inefficient) incandescent lamps may have upon the electric lighting industry of the United Kingdom; but, if we may judge from the experience of other countries where such lamps have always been on sale, it is possible to argue that the consequence of the change will not be serious. It would be of far greater moment to the industry if somebody would produce a really cheap, reliable meter; but this necessary of economical electrical distribution and utilization is still to seek. Very many meters have been put into use in connection with undertakings that began by charging on the rental system; but the change has been everywhere unpopular, for several reasons. It is not merely that the meters convict the electric light user of extravagance. If this were all, they would justify themselves in the end, because the frugal consumer would make the meter his friend. The objection to the electricity meter is that it is a costly piece of apparatus both to buy and to maintain, and that its delicacy as a piece of mechanism does not carry a corresponding refinement of accuracy in measurement.

The failure of the Woodhouse and Rawson Company, who were largely committed to the development of electrical copper depositing and other projects, illustrates the precarious nature of all such businesses. Electrical traction scored an advance in the opening of the Liverpool Overhead Railway; and the South London Electric Railway made some headway in the direction of reducing its running expenses. But here again it can hardly be said that electricity is justifying all that was promised for it, and the great *desideratum* of the Londoner—the abolition of steam on the Metropolitan Railway—seems as hopeless as ever. That class of locomotive work in which storeage batteries can be employed has been well attended to, especially in connection with the building of pleasure launches for river use; but the idea of driving road carriages in this way appears to have been given up. Mr. Reckenzaun, who died during the year, devoted some of the best years of his life, and many thousands of pounds, to experiments of this kind; but all interest in them has been buried with him.

Great interest was manifested in the striking experiments with high-frequency electric currents performed in America and in England by Mr. Tesla, and repeated by less original-minded electricians. It was thought by many that these brilliant manifestations presaged something in the way of the "light without heat" for which physical philosophers have long sighed in vain; but so far nothing has resulted from them. A long way after Mr. Tesla came the performers with electrical warming and cooking apparatus, who have amused their patrons by exhibiting various descriptions of Laputan utensils for doing very imperfectly with sixpennyworth of electricity what can be much better done with a pennyworth of coal or gas.

Attempts have been made to recommend electric lighting to local authorities in connection with refuse-destroying furnaces; and fascinating pictures have been drawn of the possibility of lighting towns by the agency of the fuel supplied by their own garbage. An experiment of this nature was decided upon by the Vestry of St. Pancras; and the Town Council of Harrogate followed suit. Meanwhile, all such schemes have been denounced by high authority as chimerical.

There was during the year a considerable extension of private lighting by electricity; and many firms that lay themselves out for this class of business have accordingly had a very fair turnover. In connection with this branch of electric lighting, the use of gas-engines, driven either by ordinary or Dowson gas, has increased in a marked degree. The suggestion made to employ gas-engines for the same purpose in assisting the development of town lighting has received attention and some application. But the chief objection to the idea is that illuminating gas is too expensive for large powers, while separate producers for fuel gas are too troublesome. There cannot be said to be any particular novelty in the private electric lighting plants laid down last year; but the apparatus usually employed in carrying out this class of work has been simplified and reduced to a workmanlike standard. For country house lighting, where money is no object, it cannot be denied that the electrician has supplanted the builder of private gas-works; and most of the gas engineering firms who formerly cultivated this branch now have electric lighting departments—which in all probability pay as well.

Mr. A. Davidson has been appointed Manager of the Perth Corporation water undertaking, in succession to the late Mr. John Peattie. Mr. Davidson is a plumber by trade. He was a town councillor, but resigned in order to become a candidate for the situation in connection with the water-works.

R. and J. Dempster, Limited.—As announced in the JOURNAL for the 19th ult., Messrs. R. and J. Dempster, of Newton Heath, Manchester, have converted their business into a limited Company; and the new arrangement came into force on the 1st inst. We understand that the conversion will not make any alteration in the management, which will be the same as heretofore. The proprietorship will also be the same, with the exception of the few shares needed to form the Company under the Act; and these have been allotted to members of the staff.

THE VALUATION OF GAS CONSUMERS.

In these days of competition, there is a tendency to push the scrutiny of each item of income or of expenditure to a very fine degree. Not satisfied with the details visible on ordinary inspection, they are submitted to a kind of mental microscope, with the result that matters which formerly attracted no attention whatever are now carefully dealt with. If such a searching examination of the expenditure side of the revenue account is found to be advantageous, something may also be done with regard to the income, albeit that this is frequently affected by factors which are beyond the control of the management. The way in which gas is used, for example, may have a more marked effect on the working expenses than any care or skill that can be brought to bear on the other side. We are continually classifying the consumption of gas as "large" or "small," as "day," "summer," "all the year round," or "winter." All of these terms have their practical significance. Since a certain magnitude of operations is necessary to enable gas to be sold cheaply, either a few large consumers, or a numerous body of small users, are indispensable. Day or summer business is advantageous as turning the storing or distributing plant to account at times when it would otherwise be lying idle. On the other hand, additions to the demand at the times of maximum supply—such, for example, as gas heating stoves, which are very likely to be called into use during winter afternoons and evenings—mean *pro ratâ* additions to the manufacturing and storing plant. But neither of these definitions approaches the most important factor, which is that of "time." A single 5 cubic feet per hour burner, in use for a year without intermission, means a consumption of no less than 44,000 cubic feet of gas per annum, and would leave no idle time for the apparatus used for manufacturing and distributing.

Gas-works plant is of a permanent character. If a million cubic feet of gas per day are required only for seven days out of the entire year, it is necessary to provide apparatus equal to the demand. In some businesses it is possible to adopt cheap temporary expedients for tiding over the busy time. But not so in gas manufacture. The apparatus once provided means a fixed charge for interest on capital, and to some extent for maintenance—apart from the number of days it is used. Gasholders or purifiers must be regularly painted; valves and other working surfaces must be maintained in fair condition; and so on. The cost of repairs and maintenance, and of interest on capital, as allotted to each 1000 cubic feet of gas sold, will bear a rough proportion to the actual, as compared with the maximum, working capacity. In the case of plant turning out a regular quantity of gas throughout the year, an excess capacity of something like 25 per cent. would be necessary to leave a sufficient margin for standing off for repair—the maximum capability would not be more than 75 per cent. The actual working seldom exceeds one-half of this amount. So that the most valuable customer is the one who uses gas for the greatest number of hours. Gas undertakings are further under the disadvantage of being compelled to supply at any time. A consumer may shut up his house and go away for a year, and not use a foot of gas during that period; he may put up oil-lamps or electric lights, keeping the gas as a reserve against accident; but if he chooses to return at any time and light up all over the house, or if his usual appliances fail at a moment's notice, he expects and can demand a full supply. The proprietor of a gas-engine expects a full pressure whenever he chooses to turn on his tap; but there is nothing to prevent him from leaving the tap closed for months at a time, if bad trade or other circumstances render such a course advisable. A consumer can fit up gas-fires in every room in the house, and demand a service and meter equal to their supply; but he need not use them for one hour throughout the year, if he does not desire to do so. Over a large area, however, these individual contingencies are not felt; and there is a fairly regular consumption, affected only by general conditions—such as the weather or local commercial matters. It is, therefore, possible to estimate, with fair approach to accuracy, the value of any consumer.

Suppose we have four gas consumers each supplied with a 10-light meter, with service pipe of suitable size. The charge per annum for maintenance and interest would be practically the same in each case. Suppose that the first uses gas without intermission, up to the full capacity of the meter; that the second uses it three hours daily, and for lighting from dusk to 10 o'clock; that the third uses it for lighting only for a similar period in the evening, and on the average for half capacity; and that the fourth keeps it simply as a reserve for use on emergency. The full capacity of the meter is 60 cubic feet per hour; so it follows that No. 1 will use some 525,000 cubic feet per annum; No. 2, 146,000 cubic feet; No. 3, 43,000 cubic feet; while No. 4 may use none at all. Comparing examples from practice with the full capacity as indicated by No. 1, it is evident that the load-factor of most of the services and meters is very low. It would be interesting to take the total meter capacity of a district, and to compare it with the actual output. The inquiry may also extend to a maximum day's output in each ase. In No. 1, this would mean 1440 cubic feet per diem; in No. 2, 570 cubic feet; in No. 3, 200 cubic feet. Or respectively 1-365th, 1-256th and 1-215th of the annual consumption. From this it is evident that, in the case of any individual consumer, a

fair idea of his value to the concern may be arrived at by comparing maximum daily with total annual consumption.

When one seeks to apply this method to any particular district, the class of intermittent consumers has the effect of reducing the average. It is questionable whether the annual consumption, in practice, is ever found to run as high as two hundred times the maximum diurnal output. There are public buildings, places of worship, &c., in which the gas may not be used for more than a few hours per week. There are offices, in which the light is not used at all for perhaps eight months out of the year. Gas-fires stand idle for about the same period. And thus it is that, in every gas undertaking, the whole plant from the retorts to the meters, experiences a great deal of "short" and of "idle" time.

Of the four classes above instanced, the first and the last are entirely theoretical, and simply serve to indicate the extreme limit in each case. In the early days of gas lighting, the average consumer occupied a position represented by No. 3; but the day and the summer consumption that has been so well cultivated of late, tends to raise him towards No. 2. It has also raised the small and intermittent consumer higher in the scale. The advance in this direction is largely responsible for the reductions in price of gas that have been the general rule; and one of the drawbacks suffered by small gas undertakings is the fact that, the price of their gas being necessarily higher, they have not been able to advance so far in this direction as their larger neighbours. One of the advantages of "cheap gas" is the fact that it increases the average sale per consumer.

This question has become very prominent in connection with the supply of electricity for lighting. On account of the short hours of darkness, and small demand for artificial light during the summer months, many electric light companies find themselves not only unable to make a profit, but actually compelled to work at a loss during that period. The hours of consumption are few, and the idle time is therefore large. On this account, the plan of allowing substantial discounts, not to large, but to long-period customers, has been suggested. In the United States, especially, a scale of prices is fixed upon that varies according to the number of hours of use per day. A lamp to be run for six hours daily may be had at a price much less than double the charge for one to be used for only three hours. The justice of this system has been defended on the ground that "readiness to supply" is as tangible an item of expense as the actual supplying; and there is much soundness in the argument. Every tradesman claims the right to encourage the most profitable lines of business. It has been further extended on paper to embrace a fixed charge to each consumer, irrespective of his consumption, for "readiness to supply." But however correct the theory, we have to deal with the fact that British notions of fairness are strongly in favour of buying by the yard or by the pound. The small consumer may be fleeced to any extent by ordinary tradesmen; but he manages to make himself heard very plainly in his dealings with public companies. There would probably be a strong outcry against any attempt to charge a fixed fee per consumer for "readiness to supply;" and the cost of this item must continue to be regarded as one of the working expenses. It can only be reduced by increasing the "regular" class of consumers; thus increasing the average consumption per consumer, per service, per meter, per mile of main, and per £1000 of capital invested.

WATER COMPANIES' RESPONSIBILITIES.

In the JOURNAL for the 19th ult., we explained the important bearing which certain decisions in regard to railway companies might have upon the statutory powers of water companies. Since that date, the case of *Green and another v. Chelsea Water-Works Company* has been tried before Mr. Justice Mathew, sitting with a special jury; and the report of the action, which appeared in our issues for the 12th and 26th ult., abundantly proves the point on which we insisted in the article referred to. The principle adopted in construing the Special Acts of railway companies must, as we argued, also prevail in regard to the statutory powers of a water company; and in the case above referred to there is an apt illustration of this contention. It is satisfactory to notice, however, that the attempt made by the plaintiffs to attribute to the Company an unreasonable liability did not find favour with the learned Judge who tried the action; and it may be assumed that the threatened appeal is not likely to result in a reversal of Mr. Justice Mathew's ruling.

Briefly, the point was whether a water company is to be regarded as holding the position of insurers. To support this proposition, the plaintiffs' Counsel contended that legislation applicable to a water company is permissive—that is to say, a company are not bound to construct water-works at all, or to lay pipes and mains; but that if the powers are exercised, the company must be responsible for any incidental injury which may be caused by the execution of the works. It was necessary however, for the learned Counsel to admit the broad principle laid down in the railway companies' case already alluded to—viz., that if the thing authorized to be done, apart from the authorization, would be a nuisance, and therefore actionable, it ceased to be actionable if it were a necessary incident to the carrying out of the powers granted by the Legislature. Among the cases cited were *Metropolitan Asylums Board v. Hill*, and *Freeman v. London, Brighton, and South Coast Railway Company;* but no reference appears to have been made to the case of the North London Tramways Company, to which attention was directed in our previous article. The truth, however, is that the proposition which the Counsel for the plaintiffs invited the Court to adopt was one which, in regard to a water company, would be absolutely novel and revolutionary. It has never yet been decided, either directly or indirectly, that water companies should be treated as insurers in a case of the kind under notice, in which injury had been caused through the bursting of a water-main. On the contrary, the whole current of authority goes to show that water companies are not insurers, and that, so long as they exercise their statutory powers with reasonable care and skill, they are to be relieved from any liability for damage which may be occasioned to the property of adjoining proprietors.

The learned Judge adopted a common-sense view when he said that with no amount of care or skill could a water company prevent the bursting of one of their pipes. Such an event is not of frequent occurrence, but it is one which is practically inseparable from the exercise of a company's powers; and, as Mr. Justice Mathew justly allowed, it would be impossible for water companies to carry on their undertakings without such a mishap now and again taking place. It is not because mischievous results may be frequent in the case of a railway company, and only occasional in that of a water company, that any distinction can be drawn between the two classes of statutory undertakings. In these circumstances, judgment was given for the defendant Company; and an important barrier has been placed in the way of those enterprising litigants who, for their own advantage, and with the aid of special pleading, would fain read into Acts of Parliament rules of liability which certainly never were contemplated by the Legislature.

Inclined Retorts at Brentford and Bow Common.—With reference to the account of the working of inclined retorts at Brentford which appeared in the last issue of the JOURNAL, we are desired to state that both these and the Bow Common settings (also mentioned in the same article) are subject to the patents held by the Automatic Coal-Gas Retort Company.

Death of Mr. F. T. Bridger.—The death is announced, on Christmas Day, of Mr. Frederick T. Bridger, Secretary and Manager of the Tunbridge Water-Works Company, which occurred after an illness of some duration. Mr. Bridger took great interest in all local movements, and was formerly a member of the Local Board; but when the question of purchasing the water-works came up, he retired.

New Year's Honour for Mr. W. H. Preece.—Among the New Year honours conferred by Her Majesty is that of Companion of the Bath for Mr. W. H. Preece, F.R.S., Engineer-in-Chief and Electrician to the General Post Office. Mr. Preece was educated at King's College, London; and he is a member of the Physical Society, the Institution of Civil Engineers, and the Institution of Electrical Engineers, of which he is President.

Death of Sir G. Elliot.—We regret to record the death, on the 23rd ult., at his town residence in Portland Place, of Sir George Elliot, Bart., whose name has lately been somewhat prominently before our readers in connection with the great Coal Trust which he projected a few months ago. The deceased baronet was all his life identified with the coal industry. He was born at Gateshead in 1815, and began life, as he after proudly boasted, at the bottom of a coal pit. From a pitman he advanced to the position of manager, and eventually became one of the most extensive colliery owners in the country. He had a good knowledge of engineering; and this, combined with the practical and scientific interest with which he followed the most important mining developments of his day, helped to place him in the high position he occupied as an authority upon all questions connected with the trade. He was held in great esteem by the miners of Durham, who more than once returned him to Parliament. He represented North Durham almost continuously between 1868 and 1880, and East Durham from 1881 to 1885. He sat again from 1886 to 1892 for the Monmouth district. He was a modern Conservative; and his political work was confined to financial and other subjects falling within the range of his special experience. He was created a baronet in 1874, in recognition of his public services. The scheme for the amalgamation of the whole of the coal-fields of Great Britain, to which reference has been already made, was regarded by him as the culmination of his life-work. This project has been fully discussed in the JOURNAL; and therefore further reference to it is unnecessary. It may be mentioned, however, that no part of it was more seriously considered by him than that which has reference to the formation of an insurance fund for those working under it. It is stated that not many days before his death he was heard to express the wish that he might be able to crown his labours by leaving the whole body of the mining population better off than he found them. Unhappily, he has been removed before his wish could be gratified. The funeral took place last Thursday; the remains being deposited in the family vault in Houghton-le-Spring Cemetery, near the colliery where the deceased worked as a boy. He is succeeded in the baronetcy by his son, George William, who was Member of Parliament for Northallerton from 1872 to 1885, and has represented the Richmond division of Yorkshire since 1886.

NOTES.

Illuminating Gas as a Legalized Toxic Agent.

It has been suggested in the columns of the *Scientific American* that the toxic property of illuminating gas should be utilized for the execution of criminals condemned to death—an operation that seems to give an infinity of trouble to the officers of the law in the United States. Hanging having been found shocking to the finer sensibilities of the American public, "electrocution" has been legalized in its stead, with the undesirable result that every execution of a condemned criminal has become an electrical experiment attended by a variety of ghastly circumstances, and not always certain in the effect. The use of electricity for this purpose was suggested by the number of fatal accidents caused by its use for lighting, &c., in the ordinary way. For the same reason, it has occurred to an ingenious American that one or two cubic feet of the illuminating gas, which, when "blown out" by thoughtless visitors to hotels in the States, is as deadly to inhale as the electric light wire is to the touch, might serve as a cheap and handy means of disposing of the superfluous population. "A simple tin case could be placed over the criminal's head, and gas could be turned into it. In a few minutes, painless death, without mutilation, would ensue." It does not appear to be known to the readers of American newspapers that a "lethal chamber," involving the use of carbonic oxide gas, has long been an appanage of the Dogs' Home in Battersea.

Paving the Carriage Ways of Large Cities.

A valuable statement as to the modern English practice in regard to paving the carriage-ways of large cities was recently communicated to the Society of Arts in the form of a paper by Mr. Lewis H. Isaacs, who spoke of paving work in London with more than 35 years' experience, during which period paving by granite setts has been perfected, and wood and asphalte pavements have been introduced and developed. Speaking of the use of setts, Mr. Isaacs declares in favour of 9 in. by 3 in. setts laid close up on at least 9 inches of concrete, barrelled 1 in 40, well channelled with smooth blocks, and grouted with cement and sand. Mr. Isaacs disparages the north-country fashion of grouting with pitch, on account of its liability to give under the influence of the sun's heat, with disastrous results both to the pavement and also to those pedestrians who may have occasion to walk over it. The only feature in favour of this method of grouting is its imperviousness to water. With regard to the durability of Aberdeen granite setts laid in such a thoroughfare as High Holborn, and relaid twice in twenty years, it appears that such cubes will last 36 years with a total vertical wear of 4 inches, and still remain fit for paving second or third class streets. Wood pavement costs, in the long run, half as much again as granite setts; but it is increasing in vogue by reason of its comparative noiselessness and easy traction. On the other hand, it is hygienically the least defeasible. Asphalte is the costliest pavement of all; but it is one of the most durable, and is the cleanest. To be seen at their best, however, both wood and asphalte require more abundant washing than they usually receive in England. From the point of view of the gas-distributing engineer, wood pavements are the most costly and troublesome to deal with. Practically, the only possible materials for paving the carriage-ways of leading thoroughfares according to modern ideas are wood and asphalte.

The Power of Electric Search-Lights.

The free-and-easy way in which electricians connected with the lighthouse service have accustomed themselves to speak of flash-lights of millions of candle power has at length aroused the attention of authorities in physical science, and protests are being published against this new form of photometric phantasy. M. Hospitalier has commented on this subject; arguing that this flash-light photometry is on a fundamentally wrong basis, and that it is absolutely impossible to compare, and to express as the function of one and the same unit, the luminous intensity of a source of light reduced theoretically to a mathematical point, and that of a luminous beam of which the rays are parallel, or sensibly so. In the first case, the intensity of the illumination diminishes directly as the square of the distance; whereas in the case of parallel rays the illumination remains constant, if atmospheric absorption is neglected. A luminous source is comparable to a magnetic pole, since in both the field varies inversely with the square of the distance. A parallel luminous beam is comparable to a uniform magnetic field. The two physical quantities are incommensurable. No expression of the intensity of a magnetic pole capable of producing a uniform magnetic field of given intensity would have any physical meaning; but this is exactly in correspondence with the photometric expressions used by inventors and constructors of lighthouse arrangements or electric arc search-lights, when they talk of these appliances projecting a parallel beam of so many million candle power. Even taking into account the real divergence of the projected rays, due to the imperfection of the projector, the so-called photometrical rating of search-lights loses all meaning, because of the want of physical identity between the magnitudes purported to be measured in the two cases. The question remains as to how calculations of the candle power of search-lights are made from the photometric data by those who are well up in the subject. Nobody seems to know upon what system this is done; and until the point is cleared up, it will be wisest to treat the candle power rating of electric lighthouses and search-lights as mythical—a conclusion which is encouraged by the irreverent way in which all these millions of nominal candle power are wiped out by a slight fog which has little effect upon an oil or gas flame of more modest pretensions.

TECHNICAL RECORD.

THE IGNITION TEMPERATURE OF EXPLOSIVE GASEOUS MIXTURES.

Under the above heading, the following communication, by Mr. A. E. Tutton, appeared in a recent number of *Nature*:—

An important contribution to our knowledge of this subject is communicated to the *Berichte* by Professor Victor Meyer, of Heidelberg, in conjunction with his assistant, Herr A. Münch. The interesting experiments which were carried out some eighteen months ago in the Heidelberg laboratory, concerning the conditions under which the explosion or silent combination of gaseous mixtures occurs, left the question of the precise temperatures of explosive combination undetermined, inasmuch as the necessary high temperatures were attained by the use of boiling salts whose temperatures of ebullition lay a considerable number of degrees apart. The researches have since been continued under conditions in which it has been found possible to determine the actual temperatures with precision. In these experiments, any possibility of the occurrence of appreciable amounts of silent combination has been avoided, in order that the determinations of the temperature of explosive combination might be unaffected by errors due to that cause. The conspicuous novelty of the method adopted consists in placing the small bulb containing the mixture to be exploded inside the larger bulb of the air thermometer employed to determine the temperature; thus at once ensuring that the explosion bulb and the thermometer bulb shall be heated to precisely the same temperature. The objection which at first suggests itself—that the heat suddenly developed at the moment of explosion might exert a disturbing influence upon the indications of the air thermometer—was proved by direct and repeated experiment to be without validity; such disturbance being found to be too small to be measured. The bulb in which the explosion is brought about is not closed; for the explosion of such detonating mixtures of gases at rest—that is to say, confined to a closed space—is so violent that, if the glass escapes pulverization, it is much distorted, owing to the temperature to which it requires to be heated being about its softening point. The distortion usually takes the form of a shrinking from two opposite points, where the glass is drawn in and distended to such an extent as to produce two internal spheres. Such deformation would, of course, alter considerably the volume of the air thermometer. This is avoided by attaching a long stem to the bulb, open at the free extremity, and passing a slow current of the gaseous mixture through the apparatus. The bulb of the thermometer was heated by means of a bath of a fused alloy, consisting of equal parts of tin and lead; and it was found immaterial whether the thermometer was directly immersed in the molten metal or protected by means of a closely-fitting refractory metal sheath. The estimation of the temperature was affected by displacing the air of the thermometer, whose volume was known, by means of a current of hydrochloric acid gas, and measuring its volume over distilled water which had recently been freed from air by boiling.

The first series of experiments were made with the detonating electrolytic mixture of hydrogen and oxygen. The gases were freed from ozone by passage through a solution of potassium iodide. They were then washed through water, with which a Woulfe's bottle was almost filled, after which they traversed a tube packed with numerous discs of brass gauze, which were found effectual in preventing the explosion from travelling back to the Woulfe's bottle. The mixed gases were then allowed to enter the explosion bulb by means of a capillary tube passing down the stem to the bottom of the bulb. The rapidity of the gaseous stream was found to exert no influence upon the temperature of explosion, within the limits imposed by the mode of experimenting. The bath was then gradually raised to the neighbourhood of the combining temperature; and the instant the explosion ensued the air, contained in the thermometer was displaced by hydrogen chloride, collected over water in the measuring vessel, and its volume ascertained on the attainment of atmospheric temperature and pressure. By displacing the air the instant the detonation was heard, any appreciable augmentation of the temperature during the moment of explosion was prevented.

As the result of several series of experiments carried out with four distinct sets of apparatus, the temperature of explosion of electrolytic hydrogen and oxygen is found to vary from 612° to 686°. It would thus appear, conformable with the supposition of Professor Van t'Hoff from theoretical considerations, that this mixture is incapable of exhibiting a sharply-fixed temperature of explosion. Moreover, it makes no difference whether the mixture is dry or moist; for, if dried, a small amount of silent combination invariably renders it again moist before explosion occurs.

It has been currently supposed that the presence of sharp solid fragments, such as those of glass, exerts a lowering effect upon the temperature of explosion of hydrogen and oxygen. This supposition has been practically tested and found wanting in accuracy. Neither glass fragments nor sea sand were found to reduce the temperature below the limits above stated. A remarkable result, however, was obtained when pieces of platinum foil and wire were introduced into the explosion bulb. It was found impossible in their presence to bring about an explosion, even when the temperature of the bath was raised to 715°. Quiet combination invariably ensued.

The size of the explosion vessel appears to be immaterial, except when reduced to very small dimensions, such as 4·5 mm. diameter, as in the case of the smallest bulb tested, when the range of molecular forces is approached. In six experiments with this small bulb, no explosion occurred; in others, the explosion did not occur in the vessel, but the quiet combustion there initiated was transmitted along the leading tube, through the tube containing the gauze discs, eventually occasioning an explosion in the wash-bottle, disastrous to the latter.

In the cases of other explosive mixtures, the admixture was effected, in the proper proportion, in a three-litre flask, from which the gases were driven first through a wash-bottle and subsequently through a test-tube, arranged likewise as a small safety wash-bottle, to prevent the explosion reaching the larger one. Carbon monoxide and oxygen, in the proportion to form carbon dioxide, were found to suffer, for the most part, silent combination in the apparatus; and the wide limits of the observed temperatures of explosion (636° to 814°) in those cases, when explosion did ensue, were found to be due to more or less of such silent combination.

Gaseous mixtures of hydrocarbons and oxygen were found, however, with the exception perhaps of marsh gas and oxygen, to exhibit practically no quiet combination; and these mixtures have afforded most trustworthy and constant temperatures of explosion. Marsh gas was found to explode, as a rule, with oxygen at temperatures varying from 656° to 678°; but occasionally quiet and complete combustion occurred. Other hydrocarbons never failed to yield an explosion.

Ethane detonated with oxygen in three experiments at 622°, 605°, and 622° respectively. A mixture of ethylene and oxygen exploded at 577°, 590°, and 577° in three consecutive experiments. Acetylene prepared by Gatterman's method (which in Professor Meyer's experience yields it in a purer state than the more recent convenient method discovered by Maquenne) explodes with oxygen with exceptional violence; the wash-bottle being destroyed in every experiment. The temperature of this explosion was very constant; 510°, 515°, and 509° being successively observed. Propane, mixed with five times its volume of oxygen, likewise exhibits a very constant temperature of ignition; 548°, 545°, and 548° being indicated in three determinations. Propylene exploded with 4½ times its volume of oxygen at 497°, 511°, and 499°. Isobutane, mixed with 6½ times its volume of oxygen, detonated at 549°, 550°, and 545°; and isobutylene, at 546°, 548°, and 537°. Finally, coal gas, mixed with thrice its volume of oxygen, was found to explode in three experiments at the remarkably constant temperatures of 649°, 647°, and 647°. It was found impossible, however, to induce a mixture of coal gas and air to explode under these experimental conditions.

It will be clearly seen, from the above experiments with gaseous mixtures of hydrocarbon and oxygen, that the temperature of explosion falls as the content of carbon increases. Thus the mean temperatures for methane, ethane, and propane are 667°, 616°, and 547° respectively. Further, the temperature also falls with the degree of saturation; or, in other words, the less saturated the hydrocarbons become, the more readily do they ignite in contact with oxygen. Thus ethane, ethylene, and acetylene explode with oxygen at 616°, 580°, and 511°; propane and propylene, at 547° and 504°; and isobutane and isobutylene, at 548° and 543°. It will also be observed, however, as would be expected, that these variations, due to difference of saturation, diminish as the series are ascended.

Low v. High Pressure Gasholders.—"A Gasholder Builder" writes as follows to *Engineering*: "I do a lot of travelling by rail; and when I look at the gas lighting of the carriages on our railways, and consider where it is stored—in the small cylinders under the carriages, sometimes at a pressure of 150 lbs. to the square inch—I wonder when some of our enlightened gas engineers will turn their immediate attention to the importance of applying this principle of gas under pressure to our city and town supplies, and abolishing for ever those large, ugly, and dangerous low-pressure holders which have been, and are being, erected at the present day. I feel certain in my own mind that whereas, under the present system, it costs £20,000 to make a gas-tank and erect a holder for a storeage capacity of 1,800,000 cubic feet of gas, the same amount of storeage could be provided under pressure on one-tenth the area of land and at one-tenth the cost of plant. Further, as a question of safety, and also of appearance, everything is in favour of gas being stored under pressure; and all that is required is that one of our engineers will take the matter up, so that he may thus inaugurate an improvement which will bring about a new state of things and a great national benefit."

HYDRAULIC POWER SUPPLY IN LONDON.

At the Meeting of the Institution of Civil Engineers on the 19th ult., a communication dealing with the above subject was read by Mr. E. B. Ellington, M.Inst.C.E., Joint Engineer with Mr. Corbet Woodall, M.Inst.C.E., of the London Hydraulic Power Company.

The paper first recorded the considerable progress made in the distribution of hydraulic power during the past five years—the number of machines worked from the system in London having risen from 609 in December, 1887, to 1755 in December, 1892; and the length of mains laid, from 27 to 58 miles in the same period. The available horse power has increased from 800 to 2600. A public supply is now given in Liverpool; and works are in progress at Birmingham, Manchester, and several foreign towns.

The first pumping-station in London, at Falcon Wharf, Blackfriars, was described by the author in a paper read before the Institution in 1887. Since that time, other stations have been established at Millbank, close by the Houses of Parliament, and at Wapping, near the entrance to the London Docks; while a fourth station is in course of erection in the City Road, near the Regent's Canal. The general arrangement of the latter stations is much the same as that at Falcon Wharf, except that at Wapping triple-expansion engines have been employed with a steam-pressure of 150 lbs. per square inch. The water used is obtained at Millbank from the gravel bed overlying the London clay. Through this bed about 150 feet of headings have been driven. The water contains iron, which is deposited on exposure to the air. For getting rid of this iron and filtering the water, the Porter-Clark lime process is employed, at a cost of 1·05d. per 1000 gallons. The average output from the station is 1½ million gallons per week.

The water at the Wapping station is derived partly from the gravel bed, as at Millbank, and partly from the London Dock. The quantity of iron in the water is much less than at Millbank; and the Pulsometer Company's "Torrent" charcoal filters are used at that station. For the purpose of clarification, "alumino-ferric" has been successfully employed. The capacity of the Wapping station is 800,000 gallons in 24 hours. The water used at the several stations is pumped into tanks, situated over the engine and boiler houses, by pumps worked by hydraulic pressure. These pumps have proved to be economical machines, and possess the great advantage of being able to work by the pressure in the mains when the main engines and boilers are stopped during the night. The only station worked continuously is that at Falcon Wharf. The total capacity of the accumulators in connection with the system is 1600 gallons, while the capacity of the pumping plant is 3500 gallons per minute. This shows that the accumulators act almost exclusively as regulators of the pressure, and have little effect in respect of storeage.

The results of tests of the Wapping triple-expansion engines and boilers, made by Mr. Bryan Donkin, show a consumption of 1·3 lbs. of coal per horse power per hour. The increased economy gained by the use of triple-expansion engines and the high steam pressure of 150 lbs. per square inch are very striking. At Falcon Wharf, with compound engines working at 85 lbs. per square inch, 4048 gallons, at a pressure of 732 lbs. per square inch, are pumped for every hundredweight of coal consumed; at Millbank, with the same engines, but with 100 lbs. per square inch of steam pressure, 4130 gallons are pumped; and at Wapping, 5118 gallons. The efficiency of the plant in respect of coal consumption, working over long periods, is much below the efficiency of the trial runs. It appears that only about 60 per cent. of the coal burnt is utilized at efficiencies obtained in the trials; and 32 per cent. of the balance is wasted by the intermittent running of the plant. Notwithstanding that the total delivery of power has more than doubled since 1887, no diminution of this loss has resulted.

The author discussed the question of whether it was possible to increase this efficiency in practice by improving the load factors; and especially whether a combination of power supply during the day and the use of the energy for electric lighting during the night would produce such a result. He arrived at the conclusion that little or no advantage in this respect would be gained by such combination. The load factor of the hydraulic supply for the year 1887 was 0·275; for the year 1889, 0·338; and for the year 1892, 0·326. It was pointed out that the improvement of the load factors in recent years over 1887 was due to the enlarged area of operations, and not to the increased quantity of power supplied; the time of maximum demand varying in the different districts served. Load diagrams were given of the electric supply on Dec. 21, 1892 (a foggy day), in Westminster, and of the hydraulic supply on the same day; and the two were combined. The load factor for the combined curve was 0·522; while the electric load factor alone was 0·533, and the hydraulic load factor 0·495. It was further pointed out that, under the most favourable conditions, a supply approaching the maximum would only be given on 280 days in the course of a year, and that it was impossible, without storeage, to obtain from any combination of supplies more than 12 hours' work out of 24—a condition which would only produce a load factor of 0·380, against 0·325 actually realized. A low load factor was likely, therefore, to be a permanent cause

of low efficiency in all methods of supplying energy which did not admit of extensive storeage. The load factor had, however, a far greater influence upon the amount of capital outlay per unit of output than it had upon the cost of fuel and station expenses.

Particulars were furnished of the actual cost of the supply of hydraulic energy for the years 1884 to 1892, under the headings of (1) station and distribution expenses, (2) repairs, and (3) general charges. In the result, it appeared that the amount of the supply was unlikely to affect the working cost favourably to any substantial extent. The experience of the cost of supply in London showed, said the author, that the total expenses had increased in direct ratio to the total output, added to a constant representing the minimum cost of working the undertaking irrespective of the output. There was no reason to believe that experience in relation to hydraulic supply in London was likely to differ materially from that of other undertakings established for furnishing, in towns, energy from artificial sources. If works were planned on a moderate scale in relation to the probable output, and to allow of extensions as required, the minimum cost of supply would be approximated to within a comparatively short period; and further development was unlikely to exercise any material effect on the cost. The influence of capital expenditure on plant in relation to output was as important as the actual expense in determining the cost at which the consumer could obtain energy. The capital outlay for hydraulic supply in London had fallen from £2·8 per 1000 gallons in 1885 to £1·24 in 1892; and a further reduction was anticipated in the future.

In conclusion, the author referred to the value of the high pressure supply for purposes of fire extinction. Attention was also directed to the value of the Pelton water-wheel for high pressures, especially for driving dynamos, in substitution of the hydraulic engines hitherto used. By this apparatus, 66 per cent. of the hydraulic energy could be converted into electrical energy, which could be obtained in this way at a cost of about 6d. per Board of Trade unit.

The Bacteriology of Water.—Under the title of "Water Bacteriology and Cholera," Mrs. Percy Frankland contributed to last month's number of *Longman's Magazine* a short, but instructive, article on what many magazine readers might regard as a repellent subject. The value of sand filtration for purifying water intended for general consumption is enforced; the now well-known cases of Altona and Hamburg during the last serious epidemic of cholera being cited as instances of the benefit resulting from its adoption and the disaster consequent upon its neglect. Mrs. Percy Frankland shows that treatment by sand, when carefully carried out, offers a very powerful barrier to the passage of microbes; and she points to the report of the recent Royal Commission as emphasizing the importance of extensive storeage and efficient filtration—two factors, in connection with water supply, the meaning and worth of which, she says, rest almost entirely on the results of bacteriological research. We have received from Dr. Percy Frankland, F.R.S., Professor of Chemistry in University College, Dundee, a copy, in pamphlet form, of the paper on "The Bacteriological Examination of Water, and the Information it has Furnished," read by him at the annual meeting of the British Institute of Public Health, in Edinburgh, in July last, and noticed in the JOURNAL for Aug. 15 last (p. 326).

Gas-Engines in Germany.—In a recent report by the United States Consul-General at Frankfort (Mr. F. H. Mason), reference is made to the extended use of gas-engines in Germany for the smaller forms of manufacture, where the motive force required does not exceed 75 to 100 horse power. Since the Frankfort Exhibition of 1891, the number has risen from 18,000 to between 24,000 and 25,000. The progress made in improving the engines and increasing their efficiency has been remarkable. The first motors exhibited and employed permanently consumed 1235 feet of gas per horse power per hour; whereas those now in use take only 28 cubic feet in the case of small, and as little as 23·75 cubic feet in the case of large engines. This proportion is stated to have been reduced in larger plants employing engines of 500-horse power and upwards to 17·6 cubic feet per horse power per hour. The economy of such a motive power for all the smaller kinds of manufacture is evident from the following statement of the price of gas per 1000 cubic feet in the principal cities of Germany: Altona, Bremen, and Mayence, 5s. 8d.; Crefeld, 5s. 6d.; Bonn, Brunswick, and Strasburg, 5s. 0½d.; Breslau, Leipsic, and Magdeburg, 5s. 0½d.; Barmen, 4s. 11½d.; Dantzig and Dresden, 4s. 9d.; Berlin and Königsberg, 4s. 6½d.; Cassel, Dortmund, Elberfeld, and Hanover, 4s. 6½d.; Frankfort, 4s. 5½d.; Cologne, Essen, and Stettin, 4s. 3d.; and Bochum, 3s. 11½d. In Frankfort there are two Companies—one English and the other German—which have parallel mains under all the principal streets, and supply gas of uniformly excellent quality. When it is considered that coal for the manufacture of gas in Frankfort is brought from England and the Ruhr district of Westphalia, it will be apparent that, for two rival Companies to prosper, in a city of 180,000 inhabitants, by selling gas at 4s. 5½d. per 1000 cubic feet, good management and the employment of the most improved methods are required. The cheapness of gas in Germany is the direct result of the care and skill with which the residual products are utilized.

REGISTER OF PATENTS.

Carburetting or Enriching Gas or Air.—Love, J., of Barking, and Weston, D., of Leadenhall Street, E.C. No. 20,860; Nov. 17, 1892.

This invention relates to apparatus for carburetting or enriching gas or air in small or large quantities.

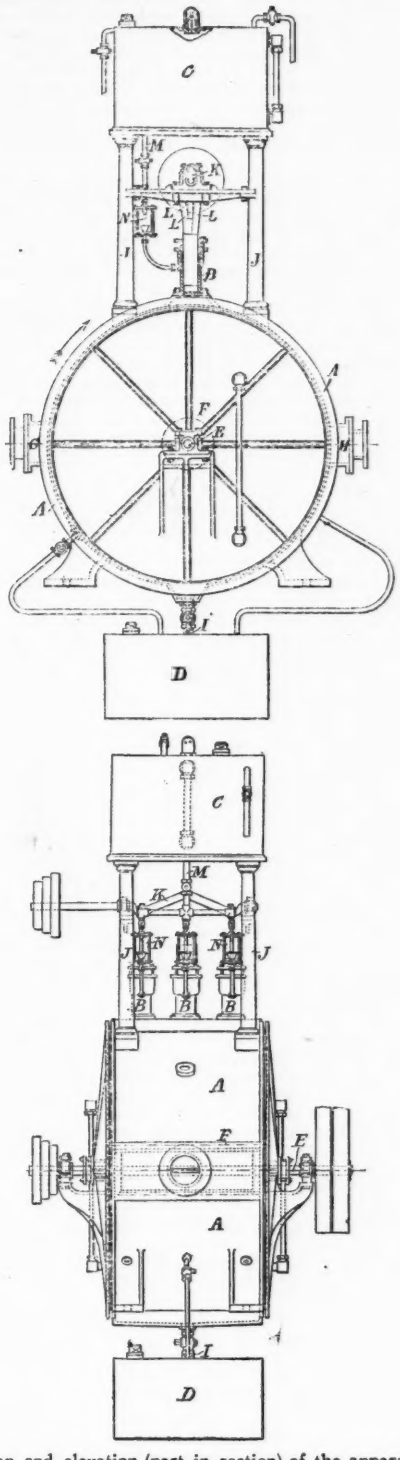


Fig. 1 is an end elevation (part in section) of the apparatus; and fig. 2 is an elevation at right angles to fig. 1.

A is the carburetting chamber. B are pumps or vaporizers, supported upon the carburetting chamber. C is a supply tank, whence the carburetting material is supplied to the pumps, which deliver it to the interior of A.

D is a "purge" tank, situated below the carburetting chamber, and employed to receive the heavy hydrocarbon deposit and other residual matter from the carburetting chamber. The chamber A is cylindrical; and at each end it is provided with a removable cover, provided with glands. A shaft E passes through the glands, and centrally through the chamber A. Within the chamber a drum F is firmly secured upon the shaft; being perforated so as to displace as little of the contents of the chamber as is possible. Radial frames are secured to the drum, as shown; and to the frames sheets of wire gauze, perforated metal, or other suitable material, are securely fastened, so as to constitute radial wings or paddles. The ends of the wings are connected by a circumferential winding of wire gauze or the like,

supported by the paddles, so as to form a polygonal or approximately cylindrical casing therefore, open at its ends. There are fast-and-loose pulleys upon one end of the shaft E, so that it can be operated from any source of power; also a pulley upon the other end of the shaft E, to enable it to operate, by means of a belt, the pumps B. Upon opposite sides of the chamber A, small chambers G and H are formed. These are in communication with the interior of the chamber by long narrow openings, extending across the full width of the cylinder wall.

In the gas-main with which the apparatus is connected is a valve at a suitable point; and at one side of this point, a supply-pipe from the main is connected to the inlet. At the other side of the point, a delivery connection is made from the outlet to the main. By means of the valve and connections, either the whole or a portion of the gas flowing in the main can be passed through the apparatus. At the bottom of the chamber is a drainage pocket, connected by a pipe I to the tank D.

At the top of the cylinder A is a cavity, the wall of which forms a base, to which three similar pumps or vaporizers B are secured. One of the pumps is shown in vertical central section in fig. 1, whence it may be seen that the bottom of each pump is provided with a diaphragm, through the perforations of which communication between the interior of the pump barrel and the interior of the cavity, and consequently of the cylinder, is afforded.

J is a metal frame placed upon the chamber A to support the tank, which is sealed. It has a suitable plug in an opening at the top, and also a pipe connection with the gas-main. A pipe leads from the top of the tank towards the ground—employed for charging the tank C with carburetting liquid. There is a valve in the top of the tank C, arranged to open inward. It is normally kept closed by the spring, which is so regulated that it will effect the opening of the valve, to allow air, at atmospheric pressure, to pass into the tank C whenever the pressure within the tank falls to (say) 3 or 4 lbs. below the pressure upon the exterior of the same. The frame is provided with bearings, in which a crank-shaft K turns. It is provided at one end with a speed cone, by means of which it may be operated by a belt from the pulley upon the shaft E, to reciprocate the pump-plungers by connecting-rods L.

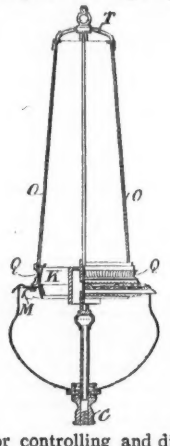
M are pipes to connect the tank C with sight-feed glasses N, into which they extend so that their lower ends are visible. The lower ends of the pipes M deliver liquid from the tank C upon sheets of wire gauze, placed over the mouths of glass funnels. Each funnel is connected directly with the pumps or vaporizers B, by pipes arranged to deliver the liquid which passes through the gauze sheets and funnels into the pump-barrels, through an orifice in each, which is normally kept closed by the pump-plunger—that is to say, it is situated high up in the side of the barrel, so as to be opened only when the pump-plunger is near the upper end of its stroke.

The operation of the apparatus is as follows: The carburetting liquid from the tank C is delivered, by way of the pipes M, upon the gauze in each sight-feed glass N; and it passes through the gauze sheets into the barrels of the pumps B, by the orifice in each. The shaft E is now rotated, turning the radial wings or paddles and the circumferential casing or drum, and simultaneously imparting rotation to the shaft K, which latter reciprocates the plungers. The liquid delivered into the pumps or vaporizers B mingles with the gas drawn thereinto during the upstroke; and the highly-enriched charge thus obtained is forced by the plungers through the perforated diaphragms into the chamber A, while the gas treated issues thereinto from the inlet in a broad thin current. A portion of the charge is carried away in the current; while the remaining portion is retained in the chamber A, either in a gaseous form or as a film or coating upon the wirework of the drum and wings.

Any of the said charge which collects as a liquid at the bottom of the cylinder, is picked up from time to time by the paddles and drum, which, being thus kept wet, bring the enriching liquid into intimate contact with the gas. Any increase or decrease of carburation may be obtained by regulating the flow of carburetting liquid; and any liquid in excess in the chamber is carried off into the tank D, and the heavy hydrocarbon may then be drawn off through the pipe I from time to time as necessary.

Regenerative Gas-Lamps.—White, W., of Buckingham Street, Strand, W.C. No. 21,775; Nov. 29, 1892.

This invention relates more especially to regenerative gas-lamps intended to be used upon brackets or standards, or otherwise supported upon bases below them, in place of being suspended from above; and



it contemplates means for controlling and directing the air admitted into the lower part of the glass globe, also a method of supplying air within the rim of the globe from above, and a way of securely centering the regenerator with a glass or other funnel over the burner.

The burner is at the summit of the gas feed-pipe, which passes through the centre of the cylindrical fitting C, the flange of which supports the glass globe resting upon a washer on the flange. The lower end of C screws on to, or in the usual nozzle of a gas-bracket; and above the screw-threaded portion the fitting is cylindrically hollowed out, but so as to retain a flange in its centre to carry wire-gauze diaphragms. Below the diaphragms and flange are holes in the wall of the fitting; and above the diaphragms and flange are other holes, made by recessing the upper edge of the cylindrical wall. The space within the fitting is closed above by a cover disc, through which the gas-tube passes. The regenerator has its air supplied through radial passages to a central chamber; while the products pass upwards in the intervals K between the walls of the passages, and the incoming air is kept separated from the products by a downwardly-directed cylindrical flange surrounding the central air chamber, which is open below. A flange on the regenerator receives an annular channelled ring, lined with asbestos, and serving to receive the lower edge of the tapered chimney O, which is preferably made of opal glass. The incoming air is deflected downward and equalized by the corrugated flange M, which lies just within the edge of the glass globe. Q is a strip of metal used for surrounding the regenerator, for the purpose of equalizing and controlling the ingoing air passing through the passages of the regenerator. This strip is corrugated in the direction of its length; and its upper and lower edges are serrated. By bending out or back the serrated points more or less (either along the whole length or at any point), the regulation of the air-inlet may be controlled, so as to give any desired form to the flame. There is a central rod rising from the regenerator, and carrying the frame or spider T, which holds the upper edge of the chimney, and is secured thereon by a nut.

Igniting the Charges of Gas-Engines.—Wetter, J.; communicated from J. Rademacher, of Berlin. No. 21,917; Nov. 30, 1892.

The proposal in the matter of this invention is that a portion of the combustible mixture of gas with air, conducted into the cylinder to serve for the next explosion, should be separated from the rest, and heated (in a chamber separated from the cylinder) at a low pressure, which heating, in the case of a four-cycle engine, may take place during the period of compression of the mixture contained in the cylinder. Shortly before ignition, this separated combustible mixture is rapidly compressed to the maximum pressure existing in the cylinder; and it is simultaneously set in communication with the gaseous mixture contained in the cylinder. By the rapid compression, the temperature of the mixture is raised above the ignition-point; and the whole of the mixture ignites suddenly, and starts the combustion of the cylinder mixture, which now communicates with it.

The compression of the separated mixture may be effected by various means—for instance, by means of a piston or ram controlled from outside. Or the separated mixture may be contained in a comparatively long tube (provided with a valve), which establishes communication with the compressed cylinder charge shortly before the moment of ignition. The charge then compresses the mixture contained in the tube, without any considerable mingling of the two mixtures.

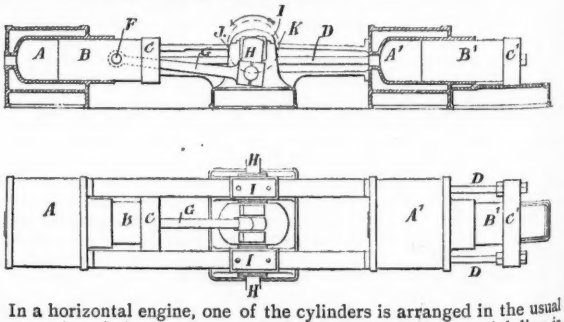
In the case of a four-cycle engine, cold or preheated combustible mixture may be drawn, during the suction period, into a tubular chamber heated by the ignition or by an external source, by the sucking effect of the working piston. The mixture is then heated during the compression period, by its contact with the walls of the chambers; and subsequently (towards the end of the compression stroke or at he beginning of the expansion stroke) it is set in communication with he compressed cylinder charge, by means of a valve controlled by the working piston or externally by the engine, whereby the mixture is compressed and ignited.

In this arrangement, the igniting-chamber may be maintained at the required temperature by closing a valve immediately after the ignition, and keeping it closed until the suction period commences. In this way, the hot gases of combustion confined in the chamber serve to heat it.

In order to maintain the igniting-chamber at the required temperature, the speed of the four-cycle engine may be regulated in the following manner: Either the valve situated between the chamber and the cylinder is kept closed by the governor during the suction period, in case an explosion does not take place; or when the load decreases, ignition continues to take place in the igniting-chamber, at every cycle (of four stages), but the power developed by the smallest charge is scarcely sufficient for keeping the engine in motion.

Gas Engines.—Fielding, J., of Gloucester. No. 108; Jan. 3, 1893.

This invention relates to a double-cylinder engine of the "Otto" cycle, for the purpose of obtaining an impulse at each revolution of the crank-shaft when working at full power.



In a horizontal engine, one of the cylinders is arranged in the usual manner in relation to the crank-shaft, except that its axial line is below that of the crank-shaft, at a distance about equal to one-fourth of the stroke of the piston. The second cylinder is placed on the opposite side of the crank-shaft, in the same axial line as the first, and facing in the same direction, so that its open end is farthest from the

crank-shaft. A pair of side-rods, passing under the crank-shaft, connect the two pistons rigidly together; suitable crossheads being formed upon, or attached to, the pistons for this purpose. The valve-gear is so arranged that one piston drives the crank during one forward stroke; the second driving it during the next forward stroke; and so on alternately. Two such double-cylinder engines, acting upon opposite cranks on the same crank-shaft, will, of course, give two impulses at each revolution of the shaft.

The engraving shows a longitudinal sectional elevation and a plan of the engine.

A A^1 are the cylinders; B B^1, the pistons; and C C^1, the crossheads on the pistons. D D are the side-rods connecting the pistons together; E E^1, the guides in which the crossheads work; F, the connecting-rod gudgeon in the piston crosshead; G G^1, the connecting-rod; and H, the crank-shaft working in bearings I. The shaft rotates in the direction shown by the arrow; the impulse being given while the crank-pin travels through the lower half circle, from J to K.

Automatically Regulating the Temperature of the Water used in Cooling the Cylinders of Gas-Engines.—Shiels, A., of Glasgow. No. 779; Jan. 13, 1893.

This invention has for its object to provide more simple apparatus than that described in patent No. 17,033 of 1891, and which mainly consists in using a diaphragm, piston, or equivalent, as the means for actuating the valve for running off hot water from, and supplying cold water to, the circulating tanks of gas-engines.

The patentee proposes to arrange (in any suitable place) a casing, in which is fitted a diaphragm made of india-rubber or other suitable material. In the casing, at one side of the diaphragm, is a passage-way connected, by piping or otherwise, to tubes containing the "sensitive fluid," and which are immersed, as in the former patent, in the water contained in the circulating tanks, or in the water jacket surrounding the cylinder of the engine. At the other side of the diaphragm, a sliding spindle is fitted; and this has a head and suitable guide-arms on it, preferably so arranged as to bear at one end against the diaphragm or a plate or projection on it. The other end of the spindle projects out through the casing, and is connected, by levers, &c., with the valve for controlling the outflow of water from the circulating tank. This valve is preferably a lifting or sliding valve; and a spring or weight (or equivalent) is provided for normally holding the spindle in its closed position, so as to keep the outlet-valve shut.

The apparatus is so arranged that, when the temperature of the water in the circulating tanks of the engine rises to a fixed point (say, 120°), the expansion of the "sensitive fluid" in the piping moves the diaphragm, and forces out the spindle against the action of the spring. This opens the outlet-valve, and runs off the hot water, which, by the action of the usual inflow ball-valve, is automatically replaced by a fresh supply of cold water. When the temperature falls again, through the influx of cold water, the sensitive fluid in the piping contracts; and the diaphragm is relieved of its pressure. As a consequence of this relief of pressure, the spring is allowed to expand, and gradually force back the spindle to its original position and close the outlet-valve.

Gas-Pressure Indicators.—Purcell, J., and Carnaby, S., of Liverpool. No. 2183; Feb. 1, 1893.

This invention relates to a device for producing an audible indication when there is an increase or a decrease in the normal pressure of the gas supply.

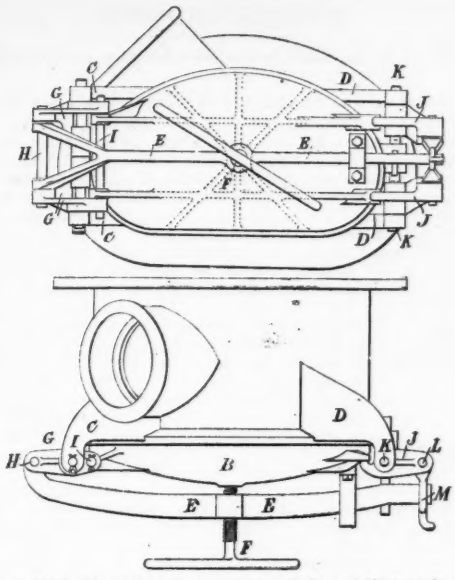
The apparatus consists of a cup with a rim inverted over the end of the gas inlet-pipe; the rim dipping into an annular trough containing mercury, glycerine, or other suitable substance. The cup is weighted, and is connected with a contact-device capable of closing an electric bell circuit by the movement of the cup. During the normal pressure of gas, the cup remains at its lowest position; but as the pressure of the gas increases, it lifts the contact device, closes the contact, and completes the circuit in which the bell and battery are placed. The bell (which is preferably of the automatic make-and-break type) is thus rung, and attention is drawn to the fact that the pressure requires adjusting. On the removal of the excessive gas pressure, the cup falls, by its weight, pulling away the contact device and opening the circuit.

To indicate inadequate pressure, the pressure of gas is arranged beneath the cup as before; and the latter, when the pressure decreases, descends, forming in its descent (by means of the contact device) contact with the wires, and closing the electric bell circuit as before.

Pressure Devices for Retort-Lids.—Matton, F. V., of Camden, U.S.A. No. 20,582; Oct. 31, 1893.

The primary object of this invention is to provide a retort-lid with means whereby it may form a close joint with the mouth of the retort by pressure from a single screw.

Upon opposite sides of the neck of the retort, a pair of brackets C and D are mounted; the ends of them projecting in front of the plane of the mouth at points a short distance beyond the opposite sides. A vertical pin extends across between the brackets C; and upon this pin, at points adjacent to the inner faces of the brackets, are pivotally mounted a pair of short links G, each of which is in effect a lever with unequal arms. The lid is pivotally secured to the inwardly extending short arms of the links by means of a pin I, which passes freely through their inner ends, and finds bearings in projecting ribs formed on the outside surface of the lid. A cotter-bar E, bifurcated at one end, extends horizontally across the lid and neck; the bifurcated arms being pivotally attached to the outwardly extending long arms of the links G, by means of the pin H. Thus the lid, while directly supported upon the pin I, is, in fact, hinged as a whole upon the pin. Near the middle of the cotter-bar is a boss, internally threaded to engage with a hand-screw F, whose inner end rests upon a bearing surface at the central portion of the lid. A pivot K extends across between the brackets D; and upon this pivot are mounted a pair of levers J, whose inwardly projecting shorter arms bear against the projecting ribs formed upon the outer face of the lid, at the extremity opposite to the hinge. Mounted on the outer ends of the longer arms of the levers is the pin, upon which are pivoted the bifurcated arms of



a swinging latch M. The inner portion of these bifurcated arms are squared, so as to fit loosely within rectangular recesses, formed in the proximate sides of the lever arms J, at the outer ends thereof. The bifurcation of the latch M extends through a sufficient portion of the whole length of it to enable it to receive the free end of the cotter-bar E; and the latch terminates in an outwardly projecting curved finger. The lid is provided with a closed guide-piece, through which the cotter-bar passes, and by which its outward movement with relation to the lid is limited. A guide-finger, having an inclined upper surface, is rigidly mounted upon the neck of the retort, in such relation to the cotter-bar that, when the latter is thrown inwards in the act of closing the lid, the under surface of the bar shall engage with the incline and ride up thereon—thus bringing the free end of the bar to the proper position for engaging in the latch.

The operation of the device is as follows: Assuming that the door is closed, and the other parts are in the position shown, the screw F is actuated so as to thrust inwards against the bearing surface upon the lid. The correlative outward thrust of the screw upon the cotter-bar itself, is transmitted through the levers G on the one side, and the levers J on the other side, to the bearing-points of the inner ends of the links upon the lid. These points are four in number—symmetrically arranged about the periphery of the lid. Thus a large fraction of the outward thrust of the screw, which otherwise would be expended (without useful result) upon the bearings of the cotter-bar itself, is directly applied to the periphery of the lid at a plurality of points properly situated for distributing the pressure and causing close contact between the lid and the mouth throughout the whole of their respective peripheries.

APPLICATIONS FOR LETTERS PATENT.

24,302.—Shears, R., "Automatic gas-meter." Dec. 18.

24,314.—Jackson, F. T., and Reynolds, W., "Illuminating lamps." Dec. 18.

24,384.—Hamilton, J. H., "Gas motor engines." Dec. 19.

24,456.—Thomas, L. V., "Gas and other burners giving light by incandescence." Dec. 19.

24,490.—Cowan, W., "Prepayment gas-meters." Dec. 20.

24,492.—Hawkyard, J., and Braddock, J., "Supplying gas or other fluid on prepayment." Dec. 20.

24,524.—Trivick, S., Head, C. J., and Head, A., "Treating coke to render it more highly combustible." Dec. 20.

24,632.—Farinetti, A., and Heyse, F. F. E., "Utilizing asbestos for vaporizing liquids and for distilling and producing gas from mineral oils." Dec. 21.

24,664.—Bickle, T. E., "Bunsen burners." Dec. 22.

24,666.—Campbell, H., "Gas motor engines." Dec. 22.

24,717.—Pinchbeck, J., "Machines for the delivery of gas after prepayment by the insertion of a coin." Dec. 22.

24,730.—Curtis, F. G. S., "Means for use in combination with conduits or conductors for the supply of gas or other fluid, or of electricity, for indicating the time during which such gas or other fluid or electricity has been consumed." Dec. 22.

24,737.—Crookshank, C. De W., "Railway carriage gas-lamps." Dec. 23.

24,763.—Thwaite, B. H., and Threlfall, G., "Recovering part of the unexpended heat in gas or similar thermodynamic motors." Dec. 23.

24,788.—Gareis, J., "Cut-off and purifier valves for gas-works." Dec. 23.

Explosion at the Gosport Gas-Works.—Shortly after eight o'clock on the evening of the 24th ult., a serious explosion occurred at the Gosport Gas-Works. Mr. G. B. Irons, the Manager, whose house adjoins the works, was quickly upon the spot; and he found that the lid of a large tar and liquor tank had been forced off, although it had been well secured. On an investigation being made, it was ascertained that there had been a leakage of gas which had found its way into the tank; and it was supposed that it had been ignited by some freshly-drawn coke deposited a short distance away. Fortunately, no personal injury resulted; but considerable alarm was caused in the neighbourhood.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Peebles Oil-Gas Process and the Huddersfield Oxy-Oil Plant.

SIR,—With reference to the first paragraph of Mr. W. Young's letter in the JOURNAL for Dec. 19, in which he insinuates that I have adopted the principles of the Peebles process to the Huddersfield plant, permit me to say that the whole of our plant was, as far as principles are concerned, designed and arranged previous to my learning anything of the Peebles process, and only modifications as regards details of retorts have since taken place.

I had the opportunity of inspecting the Young and Bell process at Peebles on March 13 last; and on my return I wrote a letter to Mr. Young, on March 16, a copy of which I enclose for insertion. The paragraph in my letter in which I said "that the Oxy-Oil Proprietary Company, Mr. Young, and myself had been working on somewhat parallel lines," referred more particularly to the arrangements made in the Huddersfield process for the return of the residual oils from the condenser to a separate set of retorts; whereas in Mr. Young's process the residual oils and fresh oils flow into the same retorts.

As for Mr. Young's friends who have visited Huddersfield, and reported to him "that the process there in operation for the decomposition of the oil into gas appeared to them to be wonderfully similar in principle to the Peebles process," all I can say is that Mr. Young will do far better by coming to Huddersfield and inspecting it for himself (where he will receive a courteous welcome), instead of trusting to such doubtful friends, who evidently are not competent to judge the difference between such processes; for, in my opinion, there could not be a more distinctive difference between the process in operation for the decomposition of the oil into gas as applied by me at Huddersfield, and the plant serving a similar object at Peebles.

W. R. HERRING.

Huddersfield, Dec. 23, 1893.

[ENCLOSURE.]

Corporation Gas-Works, Huddersfield, March 16, 1893.

WM. YOUNG, Esq., Priorsford, Peebles.

Dear Sir,—I regret I was not able to see you on Monday last, when in your neighbourhood, and take this opportunity of thanking you for allowing me to inspect your oil-process at the Peebles Gas-Works.

I think it, however, wise to inform you, and as explained to the Manager of the gas-works, that we—that is, the Oxy-Oil Proprietary Company, yourself, and myself—have been working on somewhat parallel lines; and the erection we are putting up here may, in your opinion, bear a resemblance to some of your methods. I mention this fact now in order to prevent any misunderstanding with regard to our having inspected your plant, and afterwards adopted your methods of working. As a matter of fact, all our arrangements were made some time ago, and the plant ordered, and its erection in progress.

Trusting, however, that no misunderstanding will arise,

I remain, Yours truly,

(Signed) W. R. HERRING.

Steam-Jet Nozzles for Blowing Purposes.

SIR,—In your last issue, I notice a letter upon the above subject, by Messrs. Meldrum Bros.; and I should wish, with your permission, to correct certain errors it contains. First, however, I will state that it is perfectly true that I have withdrawn the combination of the annular jet in favour of a somewhat similar arrangement which I have found, by experiment, to be distinctly superior, and so have adopted.

So far from "disparaging" the efficiency of the solid steam-jet, I am a stronger advocate of such jets than your correspondents imagine, as they will presently discover; and my last specification actually includes at least three varieties of adjustable solid jets. Any remarks I have myself made regarding such jets have been with respect to the difficulty of varying or adjusting their size and power otherwise than by throttling the steam supply.

Coming now to the particular duplex nozzle to which Messrs. Meldrum Bros. refer, it is the only one of that type ever sold, as I was dissatisfied upon testing it afterwards; and there is not another similar one in existence. I will, however, take it just as it is, because, even with its imperfections, it is amply sufficient for the present purpose. As early, then, as in the provisional specification of the first patent, I stated that "the duty of the second jet is to supplement the effort of the first (or solid) one to a greater or less extent as may be necessary from time to time, and under varying conditions." In other words, for the normal or ordinary work, I rely upon the central solid jet (in this respect, Messrs. Meldrum and myself are in agreement), and, when fitted to the complete forced-draught apparatus, I proportion it accordingly; while the second one is used as an auxiliary to assist the first, when the latter is no longer strong enough for any extra or temporarily greater work which may come upon it, or when the steam pressure may have fallen too low to give the requisite power with the solid jet alone. It will be clearly understood, then, that the object of the design is to overcome the difficulty of actually adjusting the solid jet itself, by bringing in an auxiliary one of variable power to supplement it.

Turning now to Messrs. Meldrum's figures, what do we find were the proportions of the two jets as adjusted for their experiments? Well, the aggregate areas were ·035 square inch, while the solid one was barely ·007 square inch; thus leaving fully ·028 square inch for the second or auxiliary jet. In other words, the auxiliary was set to fully *four times* the strength of that which should have been the primary, upon which primary, as already explained, I rely for efficiently doing the burden of the work.

Messrs. Meldrum, then, having failed to grasp the very elements of the principle upon which the nozzle is based, it is not surprising that they should have worked it under improper conditions, and consequently have obtained poor results. In the present type of nozzle, the side jets have about the same efficiency as an ⅛-inch solid jet; and therefore the proportional extent of their opening is of less consequence than in the above design.

I come now to a remarkable passage in Messrs. Meldrum's letter, in which they refer to a nominally annular jet not being really so, unless provision be made for admitting air to the annulus through the centre, which provision being absent in the duplex nozzle, "the annular jet itself acts as a shield to prevent access of air to the central or solid jet." To this I reply: Is it conceivable that your correspondents, after ten years' special study of steam-jets, believe that their action is in any material degree due to the friction of the jet against the adjoining air, causing that air to be dragged along with it? And, further, do they not understand that the objects of the hollow or tubular annular nozzles are: (1) To prevent the body of the nozzle, more especially when of large size, offering *mechanical* obstruction to the flow of air; and (2)—as, for example, in Adams's vortex blast-pipe—to cause the air drawn through the hollow interior, by the general action of the jet, to act upon a space distinct from that exposed to the current flowing around the outside of the nozzle? The body of the duplex nozzle, it may be stated, is too small to cause any perceptible obstruction. Finally, have they not yet discovered that a jet working in a pipe acts therein just as a piston would do, only with less solidity, by sweeping out the column of air which is in front of it, and thus producing a partial vacuum behind the jet, into which flow fresh volumes of air to be in their turn swept out? If the action were materially due to surface friction, then annular jets would be greatly superior to solid ones, by reason of the greater surface they expose for the exertion of that friction; and, moreover, solid jets of medium pressure would be as effective as similar sizes at high pressures, seeing that the velocities of the two are practically the same, and their perimeters identical.

I will now pass on to the subject of the complete blowers—that is to say, the combined steam-jet and tube in which it works. It is well known that a tube having a rounded or coned inlet of the form of the "contracted vein" offers but very small resistance to the outflow of fluids. Professor Rankine states, in at least one of his works, that the efficiency of such tubes is as high as from 97 to 99 per cent. Now, I employ this form of mouthpiece attached to a short cylindrical or slightly converging tube some five diameters long. This minimum length is necessary for circumferentially confining the column of air upon which the jet exerts its impact; and it is within this tube that the blast or current may be said to be made or produced. After its production, it should obviously be passed at once to its work with the least possible resistance; and I accordingly leave the end of the tube freely open to the full area of the ashpit. Messrs. Meldrum, I understand, employ a similar tube, but having in addition, a diverging extension of about the same length as the original tube, and gradually increasing in area till its outlet is about three times that of the tube. Your intellectual readers can form an opinion as to the value of this extension applied to a tube which already possesses an efficiency of about 98 per cent. Such diverging extensions are unquestionably useful in blowers of the Körting type, which are fixed at some distance from the furnace, and in which, therefore, the blast has to be conveyed through more or less length of piping; but they then act merely as enlarged pipes for giving greater freedom to the travel of the blast. With blowers put *direct* into a closed ashpit, the conditions are, however, essentially different.

In conclusion, I think the terms "combining-tube" or "mixing-tube," as applied to these air-pipes, are misleading, and tend to the confusion of ideas, because, although the steam and air do "mix" within them, this mixing is a mere incidental to the process of making the blast. If my view is incorrect, then the chimney of a locomotive might, with almost equal propriety, be known as a "combining-tube."

W. A. GRANGER.

102, *Brooke Road, N., Dec.* 26, 1893.

Compensation for Meters, &c., Destroyed by Fire.—In the JOURNAL for Oct. 17 last (p. 726), a correspondent asked if a gas company can legally recover the value of a hired gas-meter or appliance accidentally destroyed by fire on a consumer's premises. The Secretary of a Colonial Gas Company says the reply to such a question seems to him to depend upon the nature of the agreement existing between the gas company and the consumer. The following is clause 2 of his agreement for the supply of gas, a copy of which form is signed by every consumer of gas: "That the Company will provide and fix a meter and service-pipe from their main up to the meter, such meter and pipes to remain the property of the Company. And the said [the consumer of gas] will keep the meter and all service-pipes in good order and condition—reasonable wear and tear only excepted; and will replace the same in the event of any loss or damage by fire or otherwise; and will not disconnect or in any way interfere with the meter or service-pipes without the sanction of the Company."

The Price of Gas at Bradford.—At the last meeting of the Gas and Electricity Committee of the Bradford Corporation, some discussion took place on the question of raising the price of gas. It was reported that the loss sustained by the Corporation owing to the recent coal strike was £17,000, and that an increase of 3d. per 1000 cubic feet would cover this deficit in a year. No decision was come to; the further consideration of the matter being adjourned till next meeting.

Additional Powers for the Leicester Corporation Water Department.—Colonel W. M. Ducat, R.E., one of the Inspectors of the Local Government Board, has recently held an inquiry at Leicester into the subject of an application which has been made by the Corporation for a Provisional Order to partially repeal and amend their Water Act of 1890, so as (1) to enable them to abandon certain works authorized by it; (2) to empower them to borrow further money; and (3) to provide that the purposes of the Order shall be deemed to be purposes for which they may, under the Act of 1890, purchase additional lands. The Town Clerk (Mr. J. Storey) explained that the amount of capital authorized in 1890 was £270,000. The Corporation proposed to expend an additional £50,800; but there would be a credit of £26,800 on the other side from works abolished—leaving the net amount which the Corporation asked the Board to include in the Order for the raising of additional capital at £24,000. Evidence was given by the Consulting Engineer (Mr. Everard) and the Water Engineer (Mr. F. Griffiths). There was no opposition.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Thursday, Nov. 16, 1893.

(*Before Lords Justices* LINDLEY, SMITH, *and* DAVEY.)

Hill v. Wallasey Local Board—Laying Mains in a Private Road.

This appeal, the proceedings on which were briefly reported in the JOURNAL for Nov. 21 last (p. 941) raised a question as to the power of a Local Authority under the Public Health Act, 1875, to break up a private road in their district for the purpose of laying water-mains thereunder without the consent of the owner. The defendants were the Urban Sanitary Authority for Wallasey, in Cheshire; and the plaintiff was the owner of a private road—being a portion of a road in the defendants' district, now called Sea View Road. In April, 1892, the defendants, without notice to the plaintiff, and without any consent on his part, commenced excavating a trench on the southern end of his portion of the road, for the purpose of laying down water-mains along it to convey water from a well which the defendants were sinking in the neighbourhood of his property to another part of their district. The plaintiff thereupon commenced an action against, and moved for an injunction to restrain the defendants from digging any trenches in, or otherwise disturbing the soil of his portion of the road. Mr. Justice Kekewich granted an interlocutory injunction; and, at the trial of the action, Mr. Justice Romer, to whom the matter had been transferred for trial, made the injunction perpetual—considering himself bound, under the circumstances, by the decision of Mr. Justice Kekewich. The defendants appealed. The question turned mainly upon the combined effect of sections 54 and 57 of the Public Health Act, 1875. By section 4 of that Act, "street," if not inconsistent with the context, is defined as including "any highway (not being a turnpike road), and any road, lane, footway, square, court, alley, or passage, whether a thoroughfare or not." By section 54, "where a local authority supply water within their district, they shall have the same powers, and be subject to the same restrictions, for carrying water-mains within or without their district, as they have, and are subject to, for carrying sewers within or without their district respectively by the law for the time being in force." By section 16, "any local authority may carry any sewer through, across, or under any turnpike road, or any street, or place, laid out as, or intended for, a street." By section 57, "for the purpose of enabling any local authority to supply water, there shall be incorporated with this Act the Water-Works Clauses Act, 1863, and the following provisions of the Water-Works Clauses Act, 1847—viz., 'with respect (where the local authority have not the control of the streets) to the breaking up of streets for the purpose of laying pipes.'" The section then enumerates a series of other provisions not material to the action. The provisions for the breaking up of streets are contained in sections 28 to 34 of the Act of 1847; and by section 29 the undertakers are prohibited from entering on any private land for laying down pipes without the consent of the owner.

Mr. COZENS HARDY, Q.C., and Mr. W. M. CANN appeared for the appellants; Mr. R. NEVILLE, Q.C., and Mr. W. D. M'CONKEY represented the respondent.

The appeal was heard in October last, when judgment was reserved. This was given on the above-named day (Lord Justice Smith dissenting) in favour of the appellants. The case is of sufficient interest to justify more extended notice than that already accorded to it; and we therefore reproduce from *The Times* the full text of the judgments.

Lord Justice LINDLEY: This is an appeal by the defendants against an injunction restraining them from breaking up a private road belonging to the plaintiff, and from laying water-mains along the same. The defendants at one time asserted that the road was a public road. But this point was decided against them; and it is now conceded that the road is the plaintiff's private property, and that there is no public right of way over it. The defendants are the Urban Sanitary Authority for Wallasey, in Cheshire; and, by various Private Acts, they are empowered to supply the inhabitants of that district with gas and water. By a Provisional Order made in 1853, and confirmed by the statute of 16 Vict., c. 24, the Public Health Act, 1848 (except sections 50 to 109), and portions of the Towns Police Clauses Act (10 & 11 Vict., c. 89), and of the Towns Improvements Clauses Act (10 & 11 Vict., c. 34) were made applicable to the defendants' district. By these Acts, the defendants acquired the control and management of the public streets within their district; and some powers over private streets were conferred by later statutes—*i.e.*, the Wallasey Improvement Acts of 1864 (sections 29 to 34) and 1867 (sections 2, 6, 15, 16). By a Private Act passed in 1858 (21 & 22 Vict., c. 63), the defendants obtained power to supply the inhabitants of their district with gas and water. This Act incorporated the Lands Clauses Consolidation Act and the Water-Works Clauses Act, 1847 (except sections 75 to 83); and for the purposes of affording such supply, the defendants were to be treated as "undertakers" and "promoters of the undertaking" within the meaning of those Consolidation Acts. The plaintiff's road was within the defendants' district; but the road being a private one, the defendants had no power, under any of the Acts as yet referred to, to break it up without his consent. Their power to take the road compulsorily under the Lands Clauses Act expired long ago, and could not now be exercised, even if they desired to exercise it, which, however, they do not and never did. The defendants, as I understand, admit all that I have stated to be true. They contend, however, that they have the power to break up the road and to lay water-mains in and under it without the plaintiff's consent, by reason of the powers conferred on local authorities by the Public Health Act, 1875 (38 & 39 Vict., c. 55), which I now proceed to examine. Having regard to the definition clause in that Act, and to previous decisions upon it, the plaintiff's road is, in my opinion, a "street" within the meaning of the Act. Section 16 authorizes the defendants to lay sewers along "streets" and other places. Section 54 authorizes them to lay water-mains to the same extent as they are authorized to lay sewers. The powers conferred by these sections are far greater than any conferred by the defendants' Private Acts and the Acts which are incorporated with them. There is a compensation clause (section 308) which will entitle the plaintiff to compensation for any injury he may sustain by the exercise of the powers thus conferred on the defendants. Now unquestionably, if there were nothing more in the Act of 1875, these sections would justify the defendants in laying water-mains along the plaintiff's road without his consent, but on the terms of making him compensation for any damage he might sustain by their so doing. But the plaintiff contends that section 54 is controlled and cut down by section 57; and the case really turns upon this point. This section, it will be observed, is an enabling and not a restricting one; and an enabling section—*i.e.*, a section conferring additional powers on those who want them—ought not to be construed as a disabling section, or as restricting more extensive powers conferred by other sections of the same or any other statute. Moreover, by section 341, the powers conferred on local authorities by the Act in question are expressly declared to be in addition to any other powers they may have. But under their Private Acts, and the Acts incorporated therewith, the defendants can lay down water-mains in the plaintiff's road without his consent; and they do not require the aid of section 57 of the Public Health Act, 1875, to enable them to exercise the powers therein mentioned. The defendants are in this position: They do not want to invoke section 57, but they want the additional powers conferred on them by section 54. The combined effect of the Special Acts and of sections 16, 54, 308, and 341 of the Public Health Act, 1875, is, in my opinion, to empower the defendants to lay water-mains along the plaintiff's road; making him all proper compensation for any injury they may do to him. Much of the discussion before us was addressed to the meaning, in section 57, of the words "where the local authority have not the control of the streets." These words appear to me to have the same meaning as similar words have in those sections of the Water-Works Clauses Act, 1847 (10 & 11 Vict., c. 17), which relate to the breaking up of streets by public authorities—viz., sections 28 to 34. In these sections, the expressions "persons having the control of the streets" is apparently used by way of contrast to "owners and occupiers;" and the streets referred to as under control are apparently public streets and roads, and not private property over which there is no public right of way. (See the definition of "street" in section 2 of the Water-Works Clauses Act, 1847.) If this be so, the defendants are a local authority having control of the streets within the meaning of those words; and the restriction, if any, imposed by section 57 does not apply to them. The restriction placed by that section on those local authorities, if any, who fall within section 54, but have not control of the streets, cannot, in my opinion, apply to the defendants, who are a local authority having control of the streets. Were it not for the compensation clause (section 308), the construction which I put on the Public Health Act, 1875, would lead to great injustice; and this circumstance would afford a strong argument against such construction. But, having regard to the compensation clause, no injustice is done to the plaintiff; and no reason based on injustice can be urged in favour of the construction contended for by him. The appeal ought to be allowed with costs, and the action dismissed with costs, except so far as they have been increased by asserting the road to be a public highway; and those increased costs the defendants ought to pay.

Lord Justice SMITH: The question in this case depends upon the construction of some sections of the Public Health Act, 1875, and of the Water-Works Clauses Act, 1847, incorporated therewith; the point being whether the Wallasey Local Board are entitled to enter upon land which is the private property of Mr. Hill, undedicated to the public use, and lay water-mains and pipes therein without his consent. Mr. Justice Kekewich held that they were not; and the Board appeal. By section 54 of the Act of 1875, it is enacted that "where a local authority supply water within their district"—this is what the Wallasey Local Board are and do—"they shall have the same powers, and be subject to the same restrictions, for carrying water-mains within or without their district as they have, and are subject to, for carrying sewers within or without their district." By section 16 of this Act, any local authority may carry a sewer through, across, or under any street or place laid out or intended for a street. Section 4 enacts that the word "street," if not inconsistent with the context, includes any road, lane, or passage, whether a thoroughfare or not; and it has been held by authority which cannot in this Court be questioned that the word "street" in the Act includes any road, lane, or passage, whether public or private property. [See the judgment of Sir G. Jessel in *Taylor v. Corporation of Oldham* (4 Ch. Div., p. 408), approved of in this Court in the case of the *Midland Railway Company v. Walton* (17 Q.B.Div., p. 30).] In these circumstances, it appears to me that the land belonging to Mr. Hill through which the Local Board are proposing to carry their water-mains is a "street" within the meaning of the Act of 1875; and that, if it were not for section 57 of this Act, which I have now to consider, the Board could do what they propose without the consent of Mr. Hill. Sections 16 and 54, however, cannot, in my judgment, be read alone; they must be read in conjunction with section 57. If the Local Board require, as they do, the enactments in section 54, they must take the section coupled with section 57. It will be noticed that sections 54 and 57 are part of a group, commencing at 51 and ending at 70, in the Act of 1875, under the heading of "Powers of Local Authority in Relation to Supply of Water." When sections 16, 54, and 57 are read together, they are as follows: "Where a local authority supply water, they may carry a water-main across or under any street or place laid out or intended for a street; and for this purpose"—this is how I read the words "for the purpose of enabling" in section 57—"there shall be incorporated into this group of sections those provisions of the Water-Works Clauses Act, 1847, which relate (*a*) to the breaking up of streets for the purpose of laying pipes, (*b*) to the communication-pipes to be laid either by the undertakers or by the inhabitants, (*c*) to waste or misuse of the water supplied, (*d*) to the provision for guarding against fouling the water, and (*e*) to the payment and recovery of water-rates." Upon referring to section 57, it will be seen that these provisions of the Water-Works Clauses Act, 1847, with the exception of the one relating to the "breaking up of streets," are incorporated without any restriction whatever, whereas the provision relating to "breaking up of streets" is only to apply to those local authorities who have not the control of the streets; and consequently,

if they have such control, this one provision is not wanted, and therefore is not to apply. The real point in the case is, What is the true reading of the words "where the local authority have not the control of the streets" in this section? The incorporated sections of the Act of 1847, which relate to the breaking up of streets, enact that the undertakers—that is, the persons proposing to break up a street for the purpose of laying down water-pipes—shall not break up any street except under the superintendence of the persons under whose control and management such street shall be, and impose penalties if this be done, and also provide for the reinstatement of the street broken up; and every undertaker is (by section 29) expressly forbidden from laying down any water-pipe in any land not dedicated to public use, without the consent of the owners and occupiers thereof. It is said by the appellant Local Board that, inasmuch as they have the control of the streets generally in their district, though not of the particular road in which they are proposing to lay water-pipes, for that is the private property of Mr. Hill, undedicated to public use, they are not a local authority who "have not the control of the streets" within the meaning of section 57 of the Act of 1875—or, in other words, that they are the local authority who have the control of the streets within the meaning of the section—and therefore the incorporated sections about "breaking up streets," which include the 29th section, do not apply to them. They point to the words at the commencement of section 57, and assert that it is an enabling, and not in any way a disabling, section. I agree that this section and those incorporated with it are, in the main, enabling sections; but when a portion of one Act is incorporated with another, the whole of the incorporated portion, whether it be enabling or disabling, must, in my judgment, be read together. The real question, as before stated, is, What is the true reading of the words, in section 57, "where the local authority have not the control of the streets"? They can only mean one of two things—either, where the local authority have not the control of the streets in their district generally; or where the local authority have not the control of the streets about to be taken up. If it means the first, as the appellants contend, what is the local authority pointed at who have not the control of the streets in their district generally? It cannot be an urban sanitary authority; for they have the control of all streets in their district which are highways reparable by the inhabitants at large (section 149). They are therefore not a local authority who have not the control of the streets generally. Nor can it, in my judgment, be a rural sanitary authority. Section 54 of the Act of 1875, which is the section dealing with the laying down of water-pipes, applies equally to rural and urban sanitary authorities; for section 4 enacts that, if not inconsistent with the context, the expression "local authority," which is that used in section 54, means urban and rural sanitary authorities, and there is no context to the contrary. Moreover, why should a rural sanitary authority be unable to lay down water-pipes on private land without the consent of the owner, if an urban sanitary authority, as the appellants contend, can do so? No answer was given to this; nor do I apprehend that any can be given, for there is no warrant for saying that a rural sanitary authority is in a different position to that of an urban sanitary authority when they desire to lay down water-pipes. This difficulty faces the appellants upon their construction of section 57; and it certainly seems to me that they have been unable to surmount it, not being able to point to a single local authority to which the words in section 57 can be held to apply, if the section be read as they read it. It appears to me, for the reasons I have given, that the appellants cannot avail themselves of "a rural sanitary authority" to get themselves out of the difficulties they are landed in, upon their reading of the section. If, however, the other reading be correct, which is the respondent's reading—viz., "where the local authority have not the control of the streets about to be broken up"—no difficulty arises. Both urban and rural sanitary authorities, which are the two authorities mentioned in section 54 (the one dealing with the laying of water-pipes), will be included, and everything will run smoothly. The incorporated sections deal with those streets proposed to be broken up, and not with streets in general, in a district; and in these circumstances I ask, Why are not the incorporated sections still to apply? The urban or rural sanitary authority, not having the control of the streets about to be broken up, are in the same position as any other undertakers proposing to lay down water-pipes who have no control over the *locus in quo*. Consequently, before they break up such streets, they must give to the person under whose control and management the streets are, the notice provided by the incorporated sections; and also, as they have no control over them, they must obtain the consent of the owners and occupiers. It will be noticed that the Wallasey Local Board, under their Private Act of 1858, are entitled to payment for the water they supply. In my judgment, it is only when a local authority, be it rural or urban, have the control of the street about to be broken up that the incorporated sections which apply to the "breaking up of streets" can be dispensed with. This reading of section 57, which, in my opinion, is the correct one, avoids all difficulties, and seems to me to be eminently reasonable. It does not appear to me that the compensation section (308) in the Act of 1875 affords any real clue to the construction of section 57. The local authority have or have not the power to enter upon private property, undedicated to public use, to lay water-pipes without the consent of the owners and occupiers. It is true that it would be most unreasonable if they could do so without making compensation; but still the question remains, Does the Act empower them to do so? In my judgment, it does not; and, for the reasons given above, I come to the conclusion that the judgment of Mr. Justice Kekewich should be affirmed. I have striven to adopt the views of my brethren in the case; but I have been unable to do so. I know that I may well be wrong; but, having formed the opinion I have, I am bound to express it. I think the appeal should be dismissed.

Lord Justice DAVEY, after expressing his opinion that, under sections 16 and 54 of the Public Health Act, 1875, apart from section 57, the Local Board had power to carry their water-mains under the plaintiff's road without his consent, continued as follows: But it is said that section 57 restricts or qualifies the powers given by section 54. One must therefore examine that section and the relevant sections of the Acts of Parliament referred to in it. The first observation to be made is that section 57 is an enabling, and not a restrictive, section. But I agree that all the provisions in this group of sections must be read together; and, if according to the true construction of section 57 it has the effect of restricting the powers conferred by the earlier section, we must give that effect to it. The important words for the present purposes are, "with respect (where the local authority have not the control of the streets) to the breaking up of streets for the purpose of laying pipes." The sections of the Water-Works Clauses Act, 1847, referred to in these words are sections 28 to 34. These are framed on the assumption that the "undertakers," as they are termed, have not the control or management of the streets; and accordingly certain provisions are made for notice being given to the persons having such control or management, and for payment of penalties to such persons in case of non-compliance with the provisions of the Act. What is the meaning of the words "where the local authority have not the control of the streets" in section 57 of the Act of 1875? Do they mean "have not the control" of the particular street or streets in question in any case; or are the words used in order to define the character or description of local authority to which the clauses are made applicable, as one not having control of streets generally, or, in other words, not being a road authority? To my mind, this is the crucial point for the decision of this case. I am of opinion that the latter is the true construction of the words, and that the meaning and intention of the section is to bring into operation, in the case of a local authority who are not themselves the road or street authority, the obligation of doing the work under the superintendence of the road authority, and the other restrictions in the Water-Works Clauses Act, and also the correlative power of the road authority to superintend the execution of the work. If this be the correct interpretation of the statute, it follows that the portion of section 57 relied upon does not apply to the Wallasey Local Board, who are an authority having the control of the streets; and their general power under section 54 is not curtailed or cut down by anything in section 57. It might be sufficient to say that I find a power given in plain words in section 54; and I do not think that the plaintiff has shown sufficient grounds for qualifying or restricting the exercise of the power thus plainly given. I am therefore of opinion that the judgment of the learned Judge should be discharged, and the action dismissed. This is, of course, without prejudice to any claim of the plaintiff for compensation under section 308, though it is not, in my opinion, necessary to express this in the order.

Swansea Corporation New Water-Works.—The land required by the Swansea Corporation in connection with their Cray water scheme (powers to carry out which were obtained in 1892) has been the subject of arbitration proceedings between that body and the owners, Messrs. Cobert and M'Turk. The Arbitrator (Mr. T. Barham Foster) has awarded the latter £12,370 as purchase-money and compensation; but the Water Committee are dissatisfied with the amount, and describe it as extortionate. It is thought by several members of the Corporation that the Municipal Corporations' Associations ought to take steps to get a Bill passed through Parliament giving public bodies power to demand from arbitrators particulars of their awards.

Explosion at the Selby Gas-Works.—Early on Sunday morning last week, a somewhat serious explosion occurred at the Selby Local Board Gas-Works. It took place in what is known as the blacksmith's shop; and considerable damage was done to the surrounding property. The whole of the windows at the back of the house occupied by the Manager (Mr. J. S. Naylor) were smashed, the roofs of the blacksmith's shop and lime-house were blown off, and part of the wall damaged. Mr. and Mrs. Naylor were away from home; and fortunately none of the workmen were sufficiently near the scene of the explosion to sustain any injury. It is supposed that the cause of the accident was an escape of gas from one of the pipes of the tower scrubber, which became ignited by a gas-jet in the blacksmith's shop.

The Divining-Rod Again.—A good spring of water has just been found at Tremhall Priory, Essex, the residence of Mrs. Archer Houblon, by means of a divining-rod. It was held by a Mr. Stone, from Oxfordshire, who, by the aid of the rod, pointed out a place where he said there was water. A well was sunk at the spot indicated, and the spring tapped proved so strong that at 38 feet it rose, and almost filled the well; and at this level the water, which is stated to be of excellent quality, has remained. Mr. J. Mullins has recently visited Hayfield and New Mills with his divining-rod, at the request of Mr. F. J. Sumner, J.P., owner of the New Mills Water-Works, with the view of indicating spots where boring operations are likely to produce water. It appears that Mr. Mullins's success at Buxton and Matlock led to the requisition being sent to him to try what he could do for New Mills. He commenced operations on Phoside Moor, and pointed out several places where water could be obtained; and at two of these it is proposed to sink wells. It is computed that one will yield 500, and the other between 200 and 300 gallons of water per hour—a second spring of similar capacity being close to the latter.

The Illuminating Power of the Gas at Leeds.—At the last meeting of the Gas Committee of the Leeds Corporation, a report containing the results of the customary tests was presented. According to the test taken on behalf of the Magistrates, the average illuminating power of the gas for the month was 16·63 candles. The Corporation official test was 16·71 candles; and the return of the City Analyst (Mr. T. Fairley) was 17·7 candles. Several members complained of the bad quality of the gas. It was pointed out that the Committee had promised a minimum illuminating power of 18 candles, and that there ought to be no difficulty in securing such a standard, having regard to the fact that a large quantity of Yorkshire coal was now going into the works. The Committee had, said one member, been given to understand that a proportion of 4 per cent. of cannel was sufficient to obtain the minimum of 18-candle power; but during the past month, he noticed that the percentage was 10·1, as against 3·1 in the previous month. By way of reply, it was stated that inferior coal had been supplied by the contractors. Ultimately the different Works Committees were asked to take into consideration the questions of the illuminating power of the gas and the proportion of cannel necessary to be used, and to see that the coal was of the quality contracted for.

MISCELLANEOUS NEWS.

CHRISTMAS TIME AT THE YORK GAS-WORKS.

On Saturday, the 23rd ult., Mr. Charles Sellers, the Engineer and Secretary of the York United Gas Company, gave his usual Christmas address to the workmen—a practice which, with the exception of twelve months ago (when he was absent on account of his mother's death), he has followed for some years. The address was as follows:—

In meeting you again upon the threshold of another Christmas and another New Year, I begin to feel, as I look around, that time has thinned the ranks of those who stood before me in years gone by, while some of the faces I see now are like so many links in a long chain of memories—memories of many happy gatherings, and of many happy Christmas greetings. And although these annual greetings of mutually wishing each other "A Merry Christmas and a Happy New Year" are formal and conventional, we must not forget that while "evil wishes are apt, like chickens, to come home to roost," good wishes, oft repeated, are equally apt to bring about their own fulfilment. I am specially pleased to meet you to-day, because our present gathering bridges over a year which to me has been marked with sorrow, and because it gives me the opportunity of again shaking hands with some old workers who are fast travelling on to "the sere, the yellow leaf," when "silver threads among the gold" take the place of the ruddiness of youth I so well remember. It is, therefore, all the more needful that we should keep alive our social intercourse, which helps so much to smooth the frictions inseparable from business. As a bachelor, I do not know how fathers of families feel when their sons never cease to sow their wild oats, and when their daughters, in the words of the American preacher, "cut their tiller ropes, and go it with a rush." Neither, as a bachelor, do I know how fathers of families feel when the good conduct of their sons and daughters brings to them honour and glory in the evening of their days. But I must confess that to-day I feel proud of the conduct of our staff, for, with one or two weak-headed exceptions, that conduct, in regard to the senseless habit of drinking, has, during the past year, been in every way creditable and manly. Re-shaping Burns's definition of kingly power, I would say:

"Money can mak' a belted knight,
A lord, a duke, and a' that;
But an honest man's aboon its might,
A man's a man for a' that."

And in our case the conduct of our staff has been, in the main, honest and loyal to duty in a way which has more than once given me pleasure to report to my Board. It is true we have our troubles; for as gas men—like the old man and his ass in the fable—we are always struggling to please everybody, but, like that old man, we do not quite accomplish our object. Neither in our business can we always have our own sweet way, for competitors, in one form or another, are perpetually confronting us. But, so far as practical foresight can reach, we are in that happy position that we can stand, like Sir Walter Scott's character of FitzJames, and say to all competitors and to all feather-headed theorists,

"Come one, come all! This rock shall fly
From its firm base as soon as I."

On former occasions, it has been my custom to throw out a few hints upon home and social subjects, for, as you know, I regard home virtues as the governing virtues of the whole duty of man; so much so that I should say wherever you find a thriftless home you will as certainly find poverty and discomfort as you will find cobwebs wherever you find spiders. In fact, wherever a man expects to provide for a rainy day by thriftlessness, or expects that he can avoid the consequences of rags, ruin, and wretchedness if he spends his earnings in drink, he may, with the greatest confidence, expect to find figs growing on thistles. And if ever a lass o' Gowrie or a blue-eyed Nellie expects to find a happy home with such a man, she may also expect to pick the same figs from the same thistles, and to feed upon them, morning, noon, and night. To such a lass o' Gowrie, who may contemplate marrying such a thistle-provider, I would give her Punch's advice to persons about to marry, and say to her "Don't." There is just one more subject to which I should like to refer, and that is education. The social life of society depends upon it, and is formed by it. In fact, there is no phase of human life where education does not help us. It teaches us the philosophy of right and wrong. It unlocks the secrets of Nature, and puts us in possession of that rich library of "books in the running brooks, sermons in stones," and shows us that, rightly used, there is "good in everything." The school age is an important age, and one which fathers of families cannot overestimate. But inasmuch as among the masses of the people that age usually ends at about 14, it is clear that a youth can only get what a business man will call the tools to do his work; and therefore a business man knows that, if a youth does not use those tools after he leaves school, he cannot excel either in education or in business. I am quite aware that society is full of temptations to draw youths away from this theory. They abound everywhere, and to such an extent as to endanger the education a youth gets at school. We see evidences all round—in the fact that a large proportion of young men develop into mere "la-di-da-di swells" and "mashers;" in the fact that a large proportion give the whole of their spare time exclusively to amusements; in the fact that work—which gives the greatest interest to life, which gives the most lasting enjoyment, which is the very mother of health—is robbed of its dignity, and is sometimes even referred to as little better than slavery; and, lastly, in the fact that a large proportion of the present generation regard solid literature as a bore. Such people are always looking out for some "royal road" to knowledge and to success—a road which has never yet been found. Artemus Ward puts this very pithily. He says: "It is useless to lift a man up who is rising, as it is a waste of time to lift another up who is falling, for the first man will get up without your lifting, while the second will tumble the moment you stop lifting." Another evil resulting from the growing frivolity of the times is the weakening of individuality and a lowering of sincerity. In former times, falsehood, as the old form of oath in a Court of Justice shows, was regarded as a serious matter. But now the conventional habits of society laugh at falsehood, and treat lying as a joke. In fact, if a man now-a-days is brave enough to be himself, and to be truthful, he is regarded as a very singular and awkward individual. But let me say to all young men—and young women too—be yourselves, and have the courage to ignore those habits of society which make you all alike, like so many bricks. You may depend upon it there is only one line of difference deserving of respect between one man and another, and that is the line of difference in conduct, the line upon which I have pleasure in complimenting you to-day.

The address was received with applause. At its close, Mr. Sellers distributed a number of Christmas gifts for the children, towards the purchase of which the Directors of the Company had generously contributed; and he stated that it was his intention to keep his mother's memory alive among the workmen by presenting, as she did in her lifetime, a Christmas cake to each of those having the largest families.

THE MARKET FOR SULPHATE OF AMMONIA DURING THE PAST YEAR.

We have received from Messrs. Bradbury and Hirsch, of Liverpool a copy of their "Annual Review of the Market for Sulphate of Ammonia," for notice in the JOURNAL. Our readers are now familiar with this useful production, which comprises some general introductory remarks, a review of the course of the market month by month, and a series of tabulated statistics.

At the outset of their report, Messrs. Bradbury and Hirsch state that the sulphate market—always one of surprises—last year broke the record as far as fluctuations were concerned; the range of values having exceeded anything that might have been contemplated a year ago. The narrative of events would, they say, be more suitably called a "fairy tale" than a simple rehearsal of prosaic movements. When they wrote their pamphlet twelve months since, they gave what they thought were reasonable grounds for the position they took up as regarded the future of the market—a position which was thought untenable by almost every firm in the trade, was not applauded by dealers or consumers, and was but faint-heartedly acquiesced in by the producers, who apparently had given up all hopes of seeing values on a higher basis. They wrote, however, from conviction; and they cannot see how anybody with a fair experience, not being wilfully oblivious to the situation, and using the ordinary measure of common sense, could have formed conclusions to any extent contrary to their own, or have mistaken the signs of the times. When they strongly advocated the policy of securing requirements in good time, and warned consumers against delusive accounts of the market; when they stated that the undignified position of sulphate being sold below the cost of other nitrogenous fertilizers might be speedily changed in the spring, and that nitrate and sulphate were no longer in their correct relative positions; they surely had, in that very argument, sufficient reasons for their opinions. They point out that forecasts can never be more than opinions; but there are times when they amount almost to certainties. That prices during the past year were driven to a more extreme level than that which even the most sanguine of sellers could pretend to have expected, must be ascribed, they say, to the dilly-dallying of buyers when prices were on the upward move; and the blame rests considerably upon their own shoulders for postponing purchases until the very last moment, and then being obliged to secure their requirements at any cost. It cannot be contradicted that sulphate was more or less scarce throughout; and this indicates one of two things—either a reduced output, or, at all events, a production which does not satisfy the demand, or a large increase in the consumption with no stocks to meet it. It was a curious feature of the year that hardly at any time were stocks held in first or second hands.

Proceeding to analyze the real state of the case, Messrs. Bradbury and Hirsch deal first with production. They say there was, generally speaking, no increase; and they are not in a position to assert that there was not absolutely a decrease in many instances. The check upon the general production may, they say, be accounted for in the following way: In the first place, there was the exceptionally fine weather prevailing during the greater part of the year—extending, roundly speaking, from the end of February to the beginning of November. With so many bright, warm days, it is but natural that the consumption of gas for light and fuel should show a considerable falling off. Of course, less gas means less ammoniacal liquor, and consequently less ammonia; and the steady increase in ammoniacal products which has hitherto been experienced year by year did not exist in 1893. Then there was the interference with production caused by strikes and lock-outs. The great coal trade dispute in England must be held responsible for shortening the supplies of sulphate of ammonia; and during the Scotch strike which followed it, many works had to be closed. Moreover, the enrichment of coal gas by oil gas, and the steadily increasing manufacture of oil gas and water gas, are having their effect—although not serious at present—upon the output of gas liquor; and they will probably ultimately affect it more. Recollecting the difficulties experienced during the existence of the coal dispute, gas managers will agitate for the extended use of the above-named substitutes; and experiments will no doubt be conducted on a larger scale than ever. Lastly, there was the electric light, the use of which in the past year, it is generally estimated, increased from 25 to 40 per cent., as compared with the preceding twelve months. Although the light is still, to a certain degree, a stumbling-block on account of the great expense of its installation and the heavy cost of burning, as against gas, it must be borne in mind that the latter illuminant has been getting dearer, while the former becomes cheaper as consumption develops. "We perceive now," Messrs. Bradbury and Hirsch remark, "perhaps for the first time very plainly, that, unlike nitrate, the production of sulphate has not alone been increasing too slowly, and has been kept in check by the events of the past year, but that it is

also likely to be hampered in the future by the circumstances recited above. And, after all, this should not cause surprise; for sulphate is only a bye-product, and could not be manufactured to make a paying return by itself—at least, as long as no direct process exists. This is a matter for serious reflection."

Turning next to the consumption of sulphate, Messrs. Bradbury and Hirsch point out that this is ever on the increase; and an important fact which was discovered during the past year was that the price does not interfere with the demand or the shipments. The fact is, sulphate cannot be done without; and for compound manures, it is the nitrogen *par excellence*. "We have," say the reporters, "been constantly threatened with substitutes; and what is the upshot of it all? For years we have had a parade of nitrate. It is ever stated to be the cheapest, the most successful manure; that it will answer every purpose; that it will give the best results. But if this be the case, why is sulphate used at all; why commands dried blood still a full value; why is there such a run even on shoddy, or any material containing nitrogen? Consumers themselves know why. Nitrate cannot be mixed until the time of actual use; a manure made from it, and kept any time, will deteriorate and deliquesce; and we do not know to-day of any instance where it has been used successfully as a compound manure. It may have its chance in the spring, should sulphate be extremely dear, and nitrate correspondingly cheap, when the farmer may buy so much superphosphate and so much nitrate to put on the land. But farmers generally are not anxious to go to unnecessary trouble; and they have to face the danger of mixing by unskilled and untrained hands. Apart from this, orders are given now, and very few wait till the actual season, which, in the case of a very wet one, would put nitrate as a manure out of court completely. Then, as regards substitutes of an animal origin—dried blood, meat, meal, shoddy, &c.—the available quantities are so limited that it would be unnecessary to refer to them but for the fact of their being mentioned in connection with sulphate. Our figures farther on will show how this consumption keeps well up to the mark. New developments take place almost every year; and new countries come in as users, as their virgin soils show symptoms of exhaustion."

Messrs. Bradbury and Hirsch pass on to glance at the actual course of the figures during last year: The market opened dolefully enough, for the start was made at the now apparently absurdly low price of £10. But the reformation began early; and, during both January and February, an advance of 10s. per ton in each month was gained. With an increasing demand and heavy shipments, more rapid strides were made in March—prices running up to £12 15s. April, May, and part of June were unexpectedly quiet months; but a radical change took place in July, when prices advanced to £13 10s.—a rise which culminated in August in the extreme figure of £15. Of all the surprises the market has given us, we do not hesitate to say this has been one of the greatest; and, retracing our steps to this time twelve months ago, it would have been ludicrous for any individual to hazard a prediction of such values. This rise substantiates the possibilities of this market more plainly than any arguments we can bring forth. It was but natural that a reaction should set in after that, for sulphate had become a very dear fertilizer, and the price would have the effect of a more restricted use—*apparently so*, for, in reality, as we know now, it has not been the case. A constant and regular putting off buying until supplies are actually exhausted, combined with the action of speculators, badly caught with their cheap forward sales, will always have a temporary effect upon the market, especially when makers show themselves so anxious to put every available ounce on the market to secure such splendid prices while they lasted. It may be mentioned here that many of the smaller works, where liquor is stored until the beginning of winter, so that the production of sulphate may be a more constant one, found it to their advantage to make at once; leaving out of consideration the little extra expense in manufacturing such small parcels. This fact, of course, now reduces their output during the winter. During September, and especially towards the end of that month, prices were on the downward grade; and by the end of October values had dropped to £12 10s. again. The small stocks began to tell in November, when, much to the discomfiture of buyers, prices rose about £1 per ton; and a steady improvement continued until the first week of December. A paucity of demand and a simultaneous depression brought about a decline towards the middle of the month; the quotations at the close being £13 7s. 6d., with few spot parcels offering. We can now get a clearer view of the past year's movements, and the revolution which came over the market. We count an advance of £5 per ton, of which about £1 10s. has been lost at the close of the year; and even this still shows an enhanced value of £3 10s. over that of the same period last year. We have in not a single instance approached the low prices of 1892; and we have to go back to 1884 to find a parallel of the extreme figures which ruled in 1893. But then we were still accustomed to the high values previously prevailing, for in 1882 prices were £21, while at the beginning of 1883, £19 was being paid. So what is considered dear now, was thought a very moderate price in 1884, and there was little difference then in the relations of supply and demand.

The foregoing review of the figures for sulphate during the past twelve months leads naturally to a glance at what was done in connection with nitrate, as the latter was from time to time pointed to as likely to bring sulphate values back; and even at the present time, a superabundance of nitrate and low prices in the spring are called as evidence for the impossibility of sulphate maintaining its position. To Messrs. Bradbury and Hirsch, it really seems as if sulphate had, as they say, put up a sign, with the stereotyped inscription: "No connection with the shop opposite." They give as follows their reasons for holding this opinion: Examining the prices of the two commodities at the beginning of 1893, we see that nitrate was quoted at 9s. per cwt.; thus showing a difference of exactly £1 per ton against sulphate. So far, so good. But sulphate advanced in March to £12 15s.; nitrate, to 10s. 6d. per cwt.—a rise in sulphate of £2 10s., in nitrate of £1 10s. per ton. Nitrate and sulphate were both easier in May; but sulphate rises to £13 in June, and nitrate barely changes from 8s. 6d. per cwt. So, at the end of June, already we find a considerable alteration in the relative values. Sulphate is £3 dearer, and nitrate is 10s. per ton cheaper than at the beginning of the year. The change since April is equally startling. Sulphate gained about 10s. per ton; nitrate fell £2. Of course, it may be explained now that nitrate, not being of limited production, cannot be expected to maintain a higher value so well; and that, so far as the June prices are concerned, nitrate was not wanted then. But does this also explain why nitrate was not substituted for sulphate, seeing that it was then already £4 10s. per ton cheaper, or how the price of nitrate governs the value of sulphate at all? However, let us proceed to discuss the second portion of the year. Nitrate, owing to some momentary scarcity, advances in July; and so does sulphate—the former about 25s. per ton, the latter only about 10s. But from the end of July to the end of August, sulphate rapidly *advances*, while nitrate steadily *declines*; and the figures at the end of August show the enormous difference of £6 per ton. We have to go back again to 1883 for a similar state of things. For the rest of the year—*i.e.*, September to December—little remains to be said as far as nitrate is concerned, for its value remained almost stationary at about 9s. 3d. per cwt. We all know that this was not the case as regards sulphate, which *fell* over £1 per ton in September, a further 15s. in October, rose again in November (about £1 per ton), and declined again in December (about 10s. per ton). Verily, it *will* be difficult after this to convince anybody to take the cue from nitrate for estimating the values of sulphate. Another fallacy has simultaneously exploded. We have had one of the driest seasons on record, and during such it has always been said that nitrate alone is suitable for the soil. It will therefore remain a puzzle why sulphate has been used so extensively, and why people will pay so much more for it. It makes one almost shudder to think what might have happened had the conditions of the weather been reversed, and the season been a wet one; when, as the Apostle of Nitrate—Dr. Wagner—himself admits, the effect of ammoniacal nitrogen exceeds by far that of nitric nitrogen. One more point, and we have done with nitrate; and that question will refute the hints thrown out about the likelihood of nitrate affecting sulphate values in the spring. Nitrate can be bought for spring delivery at about 9s. per cwt.; and there are buyers of sulphate at about £13 15s. This, roughly speaking, means that buyers already will give nearly £5 per ton more for sulphate than for nitrate. If this be a forerunner of what will happen in the spring, then woe betide the unlucky consumers. Further comment seems needless.

Messrs. Bradbury and Hirsch next make a few remarks on the "future" and speculative business of the past year, and then bring the introductory portion of their report to a close with the following observations: There is now little to tell, since we have already fully discussed all the questions bearing upon the matter; and from to-day's "coign of 'vantage" there is but one answer—it is, the maintenance of values at, or near, their present level. It is impossible for any impartial judge to declare otherwise. We shall begin the new year with comparatively small stocks, with large requirements to be filled; with a considerable "bear" account open, and the production to March to a considerable extent disposed of! The production during the first three months will probably be rather under than over the mark; and it must not be forgotten that the exports for January to March, 1893, were about 40,000 tons, while the home consumption was about 15,000 tons—*i.e.*, a total of 55,000 tons to be provided for. As we have explained, and as our statistics will show, the postponement of purchases by consumers may cause an unusual strain upon the sources of supply. . . . One word of warning to the makers, and we have done. Although the actual position entitles them to look for full prices, let them not attempt to grasp extreme values as a finite thing. Prices driven too high must eventually hamper trade; and in these days of scientific research and rapid developments, other and cheaper sources will be eagerly sought and possibly found. Let rivals be avoided if possible, and as long as possible. In plain words, do not "kill the goose that laid the golden eggs." Sulphate is to-day on a sounder basis than can be cited within memory; and nothing is to be feared at present. It is wise to "leave well alone."

It is estimated by Messrs. Bradbury and Hirsch that the production of ammonia from all sources last year was 151,500 tons, distributed as follows: Gas-works, 109,000 tons; iron-works, 10,500 tons; shale-works, 27,000 tons; and coke and carbonizing works, 5000 tons. To the total production, England is estimated to have contributed 101,500 tons; Scotland, 47,000 tons; and Ireland, 3000 tons. It may be of interest to give here the grand totals for the preceding decade. They are as follows: 1892, 149,850 tons; 1891, 143,650 tons; 1890, 134,250 tons; 1889, 133,600 tons; 1888, 122,800 tons; 1887, 113,700 tons; 1886, 103,000 tons; 1885, 97,000 tons; 1884, 87,000 tons; and 1883, 75,000 tons. The reporters remark that a comparison of the production with the exports since 1891 reveals the startling fact that, while the production increased by only 15,000 tons, the exports are heavier by about 36,000 tons. Their statistics show that France, Italy, and Spain have remained behind in their drawing of supplies; and these countries have not as yet made provision for their spring requirements, This remark, they say, applies equally to the home consumption; the business hitherto having been "from hand to mouth." Had the previous quota been taken in either case, there would have been absolutely a deficiency of upwards of 8000 tons in the supply.

The review of the market month by month is next given, from which we make the following extracts:—

JANUARY.—The movements during January appear to have been a fair index to the reformation of the market; the steady improvement, the removal of stocks and production by *bonâ fide* demand, the willingness of some buyers to pick up parcels in advance, and even the avowed objection of large consumers to come forward lest they should give a further impulse to prices, were all assurances that the market was moving in a different groove to what had been the case for a long time past. The upward course was naturally distasteful to the dealers, because the bulk of the sulphate which was being shipped had been sold previously at lower prices. Consumers, by not satisfying their requirements, in spite of the nearness of the season, which promised to be an early one, were, as has been proved since, pursuing entirely wrong tactics; and it was noticed even then that sulphate was not plentiful. Though the demand towards the end was not so active, owing to the severe weather on the Continent and the suspension of

navigation, the market closed very firm, with buyers at £10 10s., or an advance of 10s. per ton since the beginning of the year.

FEBRUARY.—It was prognosticated by many at the end of January that the improvement would not be a lasting one. We contradicted this statement, and gave reasons for asserting the contrary. There was at the beginning of February some cause for alarm—so few orders coming in; and the speculators felt inclined to be jubilant. The dulness of early February was, no doubt, meant to fit in with the reports circulated by them that the advance had been simply due to some pressing requirements, and would cease almost as quickly. It was hoped by both dealers and consumers that, by abstaining from buying, stocks would accumulate and weigh heavily upon the market. But they were disappointed in this, as the demand eventually proved quite sufficient to absorb the current production; and when these buyers came in later in the month, they found very little to lay their hands on. This accounts for the decided upward movement during the second half of the month. The dealers having filled their requirements, similar doctrines to those at the beginning were again disseminated at the end of the month, and attention was drawn to the small Continental demand; it was not explained, however, that large orders had been booked towards the end of 1892 by the speculators, at very low prices, and that these orders would eventually have to be filled. We know now that these schemes were of little avail. A fair share of orders came in from the United States and the Colonies, which, at all events, barred a decline, while the speculators were standing aloof. At the end of the month, there was an unprecedented scarcity of supplies, and it was hardly necessary to point to the fact that the production was not on the increase; while since the end of September it had all been gradually absorbed—leaving no stocks in makers' hands. The advance during the month was about 7s. 6d. per ton.

MARCH.—The events during March (and by "events" is not only meant the course of the values, but also the decisive change in the general position) took almost everybody concerned by surprise. The advance to £12 10s. and £13, according to position and delivery, was not anticipated by the most sanguine observer; and still without any effort this, according to then accepted views, quite extreme figure had been reached. The causes were manifold, and may be described as a concatenation of favourable circumstances such as occur rarely in the history of a market. The principal impulse was, no doubt, the great scarcity of supplies—the famine in sulphate—the possibility of which we had previously hinted at; but the difficulties were aggravated by the exceptionally early season, as well as by the considerable increase in the shipments. In fact, the latter themselves demonstrated a reason for what had happened; those to the end of March actually showing an excess of fully 6000 tons over the same period in 1892. Sulphate had never been known to be so scarce; and though it was again predicted that the market would be much easier after the end of the month, these statements could not be founded on facts. The month ended not only with a total clearance of all available stocks, but also with many short deliveries on contracts previously entered into; and the bulk of the April production was disposed of. Many consumers nevertheless assumed a passive attitude, deluded by false impressions as to the actual position, and by mistaken hopes as to a retraction of values. At the beginning of the month, prices were still about £11 2s. 6d. (and considered high thereat); the values at the close were as near as possible £12 15s., and early April delivery was quoted close upon this figure. It was interesting to note the difference in values at the same period in previous years—viz., 1892, £10 5s.; 1891, £11 5s.; 1890, £11 15s.; 1889, £12.

APRIL.—This month did not belie the conclusions formed at the end of March; and, the little weakness at the beginning and again at the close excepted, the market was uniformly strong throughout, without, however, any further enhancement of values. Supplies were more ample than it was thought in March they could be. The fine weather, no doubt, curtailed the production somewhat; but, on the other hand, almost every ounce of liquor was being used up—makers being anxious to secure the good prices for their production, especially when towards the close of the month the market exhibited symptoms of weakness. The demand was generally good; and the home requirements especially were large. Increased consumption everywhere seems to have been the order of the day; and the question then arose for the first time whether the production really kept abreast of it. The weakness both at the beginning and at the close of April was explained by a vain attempt of the dealers to influence the market. But, being themselves without stocks, their manœuvres failed; and the market, after a slight retrogression, reached almost full figures again. The depression at the close was a rather more serious matter. The season, through the abnormally dry weather throughout the whole of Europe, ended somewhat prematurely; and consequently a good many second-hand parcels were pressed on the market. The decline of nitrate at the same period, although simply a matter of sentiment, influenced buyers in their ideas; and they began to dream of the old level of sulphate prices again. The vagaries of the Leith market supported such a view—this market apparently becoming the happy hunting-ground for speculators; the reason being that producers there seem always willing to foreclose their output for long periods, and operators seeking advantages from these circumstances. May-September delivery had been sold in the neighbourhood of £11 10s. f.o.b. Leith; and, with a view of depressing the market, these contracts were offered from second hands broadcast. There were many inquiries at the end of the month from Continental consumers, as they had let their stocks run down to an exceptionally low ebb. But the boldness of the "bears" was once more much in evidence; and, encouraged by the action of the latter, they held off longer than they would otherwise have done. It was reported that these speculators were offering freely from June to the end of the year at below the basis of £11 10s. f.o.b. Hull; and, of course, £11 10s. looked a high price when viewed from the standpoint of the beginning of the year—circumstances not being taken into consideration. The prompt quotations at the end of the month were £12 to £12 2s. 6d.; May being quoted rather lower.

MAY.—Our April report was at the time the object of scathing criticism by the dealers, because we did not accept their views of the future of the market. Its actual course leaves little to say. It was exceedingly quiet in the first part of the month; and buyers were glorying in the prospect of lower prices, which they did their best to promote. There was no difficulty in weakening the market, since there was so little consumptive demand—the continuance of the drought checking late orders. During the first half of the month, manœuvring "bears" and panic-stricken re-sellers brought about a decline of 5s. to 7s. 6d. per ton; and quotations at the close were almost identical with those at the end of April.

JUNE.—The improvement was very nearly £1 per ton. At the beginning of the month, orders were plentiful, both for prompt and July-August deliveries. The scarcity of supplies was severely felt; and the London market especially displayed great strength—the official quotations being raised quite 10s. per ton. At the beginning, consumers, in view of the unprecedentedly strong position of the market, were showing great anxiety regarding their requirements; and, seeing their chances, speculators of another kind than those to which we have been accustomed appeared on the scene. "Bull" operations—the first for many a long day—were noticed; so that the advance during the month may not be ascribed entirely to natural causes. It is, of course, difficult during the "bull" movements to discriminate between *bonâ fide* and speculative purchasers. The healthy state of the market is often impaired; quotations being fictitiously advanced. The market, indeed, did not require bolstering up; for, by its own impetus and position, it was bound to continue to advance during the summer. But it looked at one time as if that favourite invention of modern times a "corner" was to happen. It was found, however, that the available quantities were too insignificant, and that, in buying, there was too much competition for an operation on a larger scale; for consumers themselves as well as the "bears" were short. Circumstances in every respect were favourable; and such was the scarcity of parcels at one time, that orders could only be filled with difficulty. Consumers were entirely unprepared for the turn of events; the more so as the great drop in nitrate in May had induced them to look for a lower range of sulphate values. The market consequently became somewhat excited during the second half of the month; and the demand seemed to be overtaking the supplies. In this way, £13 was paid before the end.

JULY.—The advance maintained the even tenor of its way, and prices at the end of July were about 10s. per ton more than at the beginning of the month; and it became a serious and vital question how far these extreme values would be maintained. Several circumstances assisted in the furtherance of the upward movement; and among these may be mentioned the reduced production from causes already explained, the demand in excess of the previous years' requirements, and the change of front on the part of the speculators. The market did not show any very great activity during the first half of the month; but towards the middle, the firmness became marked, and a strong undercurrent indicated that parcels were badly wanted. A great many inquiries for August indicated that even those who desired an easier market most did not really anticipate a fall. The quotation at close was £13 10s.

AUGUST.—While it was remarked that the July prices had reached a level far beyond the anticipation of the most sanguine, we were certainly unprepared for the extraordinary movement of the market during August. It was naturally thought that this month, with its very small production, would be able to take care of itself; and so it did, to the tune of about £2 per ton advance. It was the greatest of surprises yet experienced; and even the fevered dream of an enthusiast could not have let him see a more astonishing revelation. In the whole course of the market, there never had been such a fluctuation, which then registered 50 per cent. increase on the previous December values. A reason was sought for this lightning advance; and the answer was simple enough: A good demand in the face of a fading supply, and the disappearance of an old enemy—*i.e.*, "bear" speculators. Of course, this unprecedented state of things could not last; and that makers themselves held this view is best explained by the so much lower prices at which contracts for future delivery could be obtained. October-March sulphate could be bought then at £13 10s. down to £13; and as the spot price was at the time £15, it was clear that no faith was placed in the maintenance of such extreme values. It was anticipated at the beginning of the month, when prices were still about £13 10s., that the market might go to £14 or a little over by the end of the month. But this figure was already reached by the middle; and such was the tightness of the situation that it became difficult to foretell where or when the advance would end. Later in the month, those who had to buy, or wished to secure prompt parcels to supply contracts, had to pay almost any price holders chose to ask; and eventually the market seemed to be practically in the hands of one or two sellers. Quotations became almost nominal; £15 was paid, and even £15 5s. was reported to have been done in a solitary instance. The latter figure was an advance of about £1 per ton for the week; and it recalled the times of yore. A lull was perceptible during the last days of the month; and some business was reported slightly below £15. September delivery was being quoted as low as £14 12s. 6d.—a position which clearly indicated the intention of the operators for a fall.

SEPTEMBER.—The drop in this month was a great surprise, for it was difficult to reconcile the condition of the market at the end with that at the beginning. The change was a most violent one. During the early part of the month, sulphate could still be readily sold, although, through the absence of orders, from consumers direct, there was a slight decline in values. The dealers, who evidently had large requirements to fill, were, of course, doing what they could to infuse weakness into the market; but, with a still comparatively small production and the total absence of stocks, it was anticipated then that prices would hold for some time. The disappointment in this respect came suddenly towards the last week of the month; and it was hard to find a reason for the fall, beyond the aggressive modes employed by the speculators. During the last few days of the month, by the quotations and sales of these dealers, and also through a few hurried resales by those who held a little stock, prices shrank rapidly; and a decline of more than £1 per ton had to be recorded. The decline had thus come rather sooner than was expected. A dead calm prevailed at the end of the month; and the field was entirely left to the speculators. It was consequently very difficult to gauge the exact

value. In some quarters, £13 15s. was still being quoted, while £13 10s. was named in others; and it was rumoured that even £13 5s. had been accepted. The general position having changed so little, there was really no sense in this extraordinary decline.

OCTOBER.—Little satisfaction was to be eked out of the dull state of the market during October; dull, however, in a certain sense only, for there was a fair amount of buying, although principally for dealers' requirements. Makers, primed by interested dealers and speculators with a gloomy outlook as to future values, were in great stress of mind as to the safest and best course of action. It was attempted to create a scare to induce them to part with their future production at low prices. The cry of "No Demand" had gone forth once more; but although the market looked gloomy indeed on the surface, there was, after all, a latent steadiness which could hardly escape notice. The requirements of the speculators were large—no doubt to cover contracts sold short; and all their tactics had the purpose to supply these with the least possible loss. The figure came down to £13 early in the month. A little steadier feeling prevailed afterwards—prices continuing, however, on the downward plane. Although there was not much offering, quotations at £12 10s. were finally made; the market being controlled by the dealers.

NOVEMBER.—The position righted itself quickly in November; and the market advanced about £1 per ton, much to the disconcertion of consumers, who had been advised that a sharp decline was imminent. One could hardly see the rationale of this view, bearing in mind the fact of small stocks and the still curtailed production in consequence of the continuance of the coal strike. The consumers and dealers soon found out their error when they appeared as buyers; and, instead of the prognosticated heavy production and the simultaneously small demand (the rule in former years), they found the supply generally disposed of. Consumers had allowed their stocks to run down to the lowest ebb; and they received bad advice when they were told to keep out of the market to make prices come down. The influence of the coal strike was criticized in many ways, perhaps all more or less near the truth; but, at all events, it did not make any difference to the tendency of the market. It was said by some that the scarcity was only temporary, because gas liquor was being largely stored, and was not made into sulphate on account of the very dear coal; and the natural conclusion therefrom was that, after the end of the strike, the market would be swamped. However, matters turned out differently. True, there was liquor in the wells, but not the quantities surmised; and in many instances there was no accumulation—sulphate having been produced without interruption. In fact, it was eventually found that there was a falling off somewhat in the liquor returns. Thus, even at the end of November, we were still unprecedentedly short of supplies. Stocks did not exist beyond the sulphate actually in course of manufacture; and it was doubtful whether the deficiency could be overtaken. The turning out of the Scotch miners also did not augur well for a heavy production in December. It goes without saying that the continuance of "bear" movements had a good deal to do with the depression still prevailing in the early part of the month; and the rapid change which took place is accounted for in some measure by the dealers' eagerness to cover their short sales, as well as by the inclination of consumers to come more freely into the market. In this way £13 10s. was reached again by the end of the month; and the purchases of January-April at £13 15s., and May-September at £13 10s., displayed confidence in the future of the market. It was noticed during the latter part of the month that the "bear" selling had entirely ceased.

DECEMBER.—This month proved unsatisfactory in many ways. Prices were good only just long enough to create much disappointment in the end; and the demand, leading at first to great expectations, finally fell away to nothing as far as consumptive requirements were concerned. The dealers were the largest, if not the only, buyers during the second half of the month; and had they not been obliged to make these purchases in fulfilment of contracts, values would have suffered a great deal more. Of course, towards the close of the year, the Christmas holidays always cause a break in business; and, especially when prices are high, the "festive season" is gladly made an excuse for putting off unfavourable purchases. Still stocks remain low; so that, from a producer's standpoint, not much has to be feared. Prices had run up during the first half of the month to £13 17s. 6d.; but quite 10s. per ton of this was lost before the close of the month.

From the tables which are given at the end of the "Review," we take the following:—

Production, Deliveries, and Exports of Sulphate of Ammonia during the Past Three Years.

	1891. Tons.	1892. Tons.	1893. Tons.
Production—			
England, Scotland, and Ireland from all sources	143,000	150,000	151,500
Deliveries and Exports—			
Germany, Denmark, Sweden, Russia, &c.	28,000	32,000	32,000
France, Spain, and Italy	19,000	33,000	27,000
Belgium and Holland	23,000	23,000	27,000
America and Colonies	20,000	17,000	26,000
Home consumption	43,000	42,000	37,500
Stocks at works	10,000	3,000	2,000
	143,000	150,000	151,500

Comparative Weekly Prices of Sulphate of Ammonia and Nitrate of Soda during the Year 1893.

Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.	Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.	Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.	Week ending	Sulphate of Ammonia. Per Cwt.	Nitrate of Soda. Per Cwt.
	s. d.	s. d.		s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
Jan. 7	10 1½	9 0	April 1	12 6	10 6	July 1	13 1	9 6	Oct. 7	13 0	9 3
,, 14	10 3	9 0	,, 8	12 7	10 7½	,, 8	13 1½	10 3	,, 14	12 10½	9 3
,, 21	10 4½	9 3	,, 15	12 6	10 9	,, 15	13 2	10 0	,, 21	12 9	9 3
,, 28	10 6	9 6	,, 22	12 5	10 6	,, 22	13 3	9 9	,, 28	12 6	9 1½
Feb. 4	10 6	9 7½	,, 29	12 3	10 3	,, 29	13 4½	9 9	Nov. 4	12 6	9 1½
,, 11	10 5	9 10½	May 6	12 0	9 9	Aug. 5	13 9	9 9	,, 11	12 9	9 1½
,, 18	10 7½	9 10½	,, 13	11 10½	9 0	,, 12	14 0	9 4½	,, 18	13 1½	9 0
,, 25	10 10½	10 1½	,, 20	11 9	8 10½	,, 19	14 3	9 3	,, 25	13 6	9 0
March 4	11 1	10 0	,, 27	12 0	8 9	,, 26	15 0	9 3	Dec. 2	13 7½	9 3
,, 11	12 0	10 1½	June 3	12 1½	8 7½	Sept. 2	14 10	9 3	,, 9	13 10	9 1½
,, 18	12 5	10 3	,, 10	12 2	8 6	,, 9	14 9	9 3	,, 16	13 9	9 1½
,, 25	12 7	10 4½	,, 17	12 6	8 6	,, 16	14 8	9 3	,, 23	13 4½	9 3
			,, 24	12 10	8 7½	,, 23	14 3	9 3	,, 30	13 3	9 3
						,, 30	13 4½	9 3			

Average Prices per Ton of Good Grey (24 per cent.) Sulphate of Ammonia, f.o.b. Hull.

YEAR.	JAN.	FEB.	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	Average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1884	14 0 6	14 5 0	14 11 6	14 10 6	14 7 6	14 13 9	14 19 0	15 8 6	15 6 3	14 12 6	13 12 0	13 3 1½	14 9 3
1885	12 12 9	12 1 3	11 18 3	11 15 4	11 3 6	11 18 3	11 14 3	11 16 6	11 2 6	10 12 6	10 8 9	10 5 9	11 9 1½
1886	10 14 6	11 5 7½	12 11 11	12 5 0	10 17 0	11 0 7½	11 3 6	11 5 7½	10 18 5	10 13 9	10 11 11	10 15 7½	11 3 7½
1887	11 12 0	11 14 6	12 3 9	11 5 3	11 13 3	12 3 9	12 12 6	12 12 0	11 17 0	11 9 0	11 9 9	11 19 6	11 17 8
1888	12 15 8	12 5 8	12 0 0	11 18 2	11 7 6	11 13 0	11 12 10	11 9 8	11 7 9	11 14 8	12 6 7	12 5 0	11 18 0½
1889	12 10 7½	12 4 8	11 19 0	11 18 9	11 19 1	11 19 6	11 16 7	12 0 9	12 2 10	11 18 2	12 1 0	12 5 4	12 1 4½
1890	12 0 11	11 16 10½	11 16 0	11 7 2	11 5 3	11 4 1	11 8 5	11 12 3	11 11 3	11 10 4	11 1 3	10 14 1	11 9 0
1891	10 13 2	10 18 9	11 5 11	11 3 9	11 0 3	10 17 6	10 13 0	10 16 3	10 14 0	10 11 3	10 7 6	10 3 9	10 15 5
1892	10 9 9	10 9 1	10 4 8½	10 4 0	9 19 1	9 15 7½	9 18 0	9 17 2	9 19 8	10 1 9	10 2 6	10 1 3	10 1 10½
1893	10 6 3	10 12 2	12 0 4	12 9 0	11 18 2	12 8 2	13 4 0	14 5 0	14 7 1	12 15 8	12 19 5	13 11 3	12 11 4½

Average Prices, 1871–1883.

1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883
£19	£21	£18 3s. 9d.	£17 2s. 6d.	£18 10s.	£18 12s. 6d.	£19 16s. 3d.	£20 5s.	£18 8s. 9d.	£19	£20 4s. 6d.	£20 8s. 6d.	£16 11s.

An Electric Lighting Scheme for Sunderland.—The Highways Committee of the Sunderland Town Council have for some time had under consideration the supply of the electric light in the borough; and they recently provisionally accepted tenders for the work, amounting to £15,074, as against the estimated expenditure of £21,000. At their meeting last Wednesday, the Council confirmed the acceptance of the tenders, and granted the Committee permission to secure a loan not exceeding £25,000 for carrying out the whole scheme.

The Management of the Stoke Gas-Works.—In connection with this subject, the Stoke Town Council, at their last meeting, considered in private the following recommendations of the Gas Committee: "(1) That the Secretary be responsible for all the office work, and that the clerk be under his direction. (2) That, after considering the application of the clerk for an increase of salary, this Committee is of opinion that the work of the office does not warrant one; and (3) that the foreman have entire control of the manufacturing department up to and including Jan. 31 next." The recommendations were agreed to.

A Return as to Sewage Precipitation Systems.—In the House of Commons last Friday, a return was ordered, on the motion of Mr. Tomlinson (Preston), "showing the number of urban sanitary districts and contributory places in rural sanitary districts in England and Wales in which systems for treating sewage by precipitation are in operation, and whether in such cases the precipitate is of a saleable value."

Norwich Water-Works Company.—At the half-yearly meeting of this Company last Wednesday week, it was reported that, after meeting all the working expenses, the debenture interest and the dividend on the preference shares, there remained a balance sufficient to pay a dividend on the ordinary shares at the rate of 6 per cent. per annum, and leave £691 to be carried forward. The Directors referred, with deep regret, to the death of Mr. Thomas Hawksley, who had been the Company's Engineer-in-Chief for the past 36 years, and announced that they had appointed Mr. Charles Hawksley to the position. The report was adopted.

THE OLDHAM CORPORATION GAS UNDERTAKING.

The Comparison with Manchester.

The publication of Mr. Southern's "Memorandum," the text of which was given in the JOURNAL for the 12th ult., in which a comparison is drawn between the working of the Manchester and six other Corporation gas undertakings, has attracted considerable attention in Oldham. The Oldham undertaking is one of the six which appears in Mr. Southern's tables, and, in some respects, not to advantage. In the matter of capital expenditure, Oldham is favourably situated. The amount upon which interest has to be paid is equal to 7s. 9d. per 1000 cubic feet of gas sold; and, with the exception of Manchester, where the figure is stated to be 4s. 4d. per 1000 cubic feet, it is the lowest in the list. Oldham also compares favourably with other towns in the matter of price; for 2s. 2d. per 1000 cubic feet is the lowest, and is charged only by Oldham and Birmingham. Exception is, however, taken in Oldham to the statement that the net profit handed over in aid of the rates is only 0·32d. per 1000 cubic feet of gas sold. This, it appears, was the amount taken out of the net profits for the year 1892. But a balance was brought forward from the previous year, and the actual sum paid to the borough fund in aid of the rates was equal to 1·5d.; and if the value of the gas supplied free to the public lamps and municipal buildings is added, it would be equal to 3·6d. per 1000 cubic feet. It is pointed out that, under their last Act of Parliament (1886), the Corporation of Oldham are restricted in the amount which may be taken from the profits of the gas-works, and employed in the reduction of the rates. The sum set aside as profit cannot exceed 6 per cent. on the borrowed capital; and out of this the interest and sinking fund have to be paid. The table as to the production of gas, the illuminating power, and the percentage of cannel used, places Oldham in a not unfavourable position. The illuminating power of its gas is the highest in the list, although only 8 per cent. of cannel is used; and the production per ton of coal was 10,204 cubic feet, against an average for the towns named of 9783 cubic feet. In the remaining tables, which give the amounts received for residuals and the net cost of coal, Oldham is less satisfactorily placed; and it is to these that particular attention has been directed. The Oldham Corporation received for residuals 5s. 2d. per ton of coal carbonized, or 38·40 per cent. on the cost of the coal. In the case of Manchester—and it is in dealing with residuals that Mr. Southern says the "management is the most susceptible of improvement"—the receipts were 5s. 6d. per ton of coal, or 41·23 per cent. on the outlay. The net cost of raw material per 1000 cubic feet of gas sold, after deducting residuals, was 10·4d. both in Manchester and Oldham; while calculated at the cost per ton, after deducting receipts for residuals, Oldham paid 8s. 3d., as against 7s. 10d. in Manchester. The difference is somewhat striking when it is remembered that, from Mr. Southern's point of view, Manchester did exceedingly badly, and used 59·72 per cent. of cannel as against only 8·02 per cent. in Oldham. The explanation offered by an Oldham newspaper is ingenious, if not convincing. "It should," says the paper in question, "be borne in mind that, as stated above, Oldham has the highest illuminating power; and the cost of material must of necessity be greater. Also that all the other towns named are more favourably placed as regards carriage between the coal-fields and the works. The amount paid for carriage and the increased illuminating power will, no doubt, account mainly, if not entirely, for the increased cost of coals here, as compared with other places. The year 1891-2, to which the tables apply, was exceptional as regards coke. The year commenced with heavy stocks on hand, and low prices had to be taken in order to clear them out." The difficulty is, of course, to reconcile the low percentage of cannel used with the high price paid for the material carbonized. The illuminating power of the gas supplied in Oldham is only fractionally higher than that of Manchester; and although there may be local circumstances which make the charge for carriage an exceptionally heavy item, it is not obvious, on the face of it, that Oldham is less favourably placed in this regard than Manchester, Birmingham, Bolton, Leicester, or Salford. It is a point in Mr. Southern's attack on the Manchester management that, in consequence of the large proportion of cannel used there, "the cost of material is, as might have been expected, much higher in Manchester than in most towns." But the fact is that in Oldham it is as high as in Manchester; while the proportion of cannel used is, as already pointed out, exceptionally low.

THE PROPOSED PURCHASE OF THE KENDAL GAS AND WATER WORKS BY THE CORPORATION.

Adverse Vote of the Ratepayers.

A check has been given to the course of the negotiations for the transfer of the undertaking of the Kendal Union Gas and Water Company to the Corporation of Kendal. On Tuesday, the 19th ult., a meeting of the Town Council was held at which the previous resolution in favour of the purchase was confirmed by 17 votes to 2. This meeting was followed on the 22nd by a meeting of ratepayers, called under the provisions of the Borough Funds Act, to approve the decision of the Corporation to promote a Bill in Parliament for the purpose of carrying out the agreement for the purchase of the undertaking. At the Town Council meeting, there was very little discussion on the subject; and that which there was, only had reference to isolated points. At the town's meeting, however, the scheme was warmly debated for four hours. The Mayor (Mr. Bindloss) presided, and moved a resolution expressing approval of the course which the Corporation desired to follow. This was seconded by Alderman H. Wilson, who said the Corporation had given the subject earnest and careful attention. The Legislature had invited municipalities to get the supply of gas and water into their own hands when opportunity offered; and the Corporation of Kendal had elaborated a scheme, which they did not say was faultless, but which was at least practicable. The Borough Treasurer (Mr. C. Graham), laid before the meeting a financial statement with regard to the price to be paid for the undertaking, the estimated income and expenditure, and the suggested outlay for the improvement of the water supply. Mr. J. E. Hargreaves, who had previously opposed the scheme in the Town Council, proposed an amendment to the effect that the meeting refused to sanction the purchase at the enormous price which it was proposed to pay. Referring to the action of the Corporation in preparing a memorial to the Local Government Board on the subject of the water supply, and to the sudden change of front and the adoption of the scheme for the purchase of the Company's works, he remarked that the readiness with which the Company jumped at the proposal gave him the idea that there had been private wire-pulling at work, in order to get this concern, which was a failure, foisted on to the ratepayers at an exorbitant figure. He was in favour of the Corporation having control of the water supply; but he did not think they should acquire the whole undertaking at the price which had been provisionally agreed upon. If the Corporation did not buy the concern, the Company would be compelled to go to Parliament for further powers; and he did not believe they would be able to maintain their high dividends at the expense of the ratepayers. Mr. W. B. Thompson, another member of the Council, in supporting the amendment, strongly opposed the taking of gas making into their own hands, seeing the strides which electric lighting was making. Mr. J. Monkhouse, also a member of the Corporation, contended that the arguments in support of the contention that the proposed price was too high were fallacious. He pointed out that, in other towns where corporations had taken over the supply of gas and water, lower prices had been charged to consumers, and large sums were handed over in relief of the rates. It was absurd to say that the electric light would prove a rival to gas under present circumstances, for statistics everywhere proved that it did not interfere with its consumption. As to the price to be paid for the undertaking, he believed they had stolen a march on the Company; and Mr. Silverthorne had shown them how the interest could be paid, the principal redeemed, and the price of gas reduced without costing the ratepayers a penny. Mr. G. J. M'Kay, the Chairman of the Finance Committee of the Corporation, opposed the purchase at the price proposed to be paid, which, he thought, would involve bankruptcy to the town for many years to come. He said his opinion was that the Corporation should acquire the water-works alone; and he had been assured that they might obtain an Act to enable them to do this. Mr. Jeffreys, whose works and residence are lighted by electricity, spoke of the difficulties in the way of a general adoption of this illuminant. By this time the meeting was getting impatient, and a vote was taken. Many of those present did not vote; but, of those who did, a majority were in favour of the amendment.

HUDDERSFIELD CORPORATION GAS SUPPLY.

At the Meeting of the Huddersfield Corporation on the 20th ult, the minutes presented by the Gas Committee stated that the Mayor (Alderman Brook), the Chairman and Vice-Chairman of the Committee, together with Alderman Haigh and Mr. Calvert, had been re-appointed a Sub-Committee to consider the subject of the disposal, or otherwise, of the plant in connection with the old Mold Green Gas-Works. The report of the Manager (Mr. W. R. Herring) showed the average illuminating power of the gas for October to be equal to 19·16 candles; and for November, to 17·63 candles. A letter had been received from the Secretary of the Netherton Gas Company, with reference to the intention of the Corporation to supply gas to the Netherton and South Crosland district, and asking them if they would be willing to take over the pipes and apparatus put down by the Company. It was resolved to inform the Company that the Corporation were willing to meet them in a fair and amicable spirit, and to take over such of the pipes and apparatus as might be found to be of use to the Corporation; and the Mayor, Chairman, and Vice-Chairman were appointed a Sub-Committee to meet the Directors of the Company, with a view to discussing the matter, and arriving at a satisfactory settlement. Alderman Stocks having moved the adoption of the minutes, Mr. Brearley drew attention to an account of an interview with the Chairman of the Gas Committee (Alderman Stocks) which had been inserted in a report from Dr. Thorne relative to experiments which had been made with oxy-oil gas. This account, he said, appeared in a newspaper after the Committee had ordered the report to be printed; and he wished to know on whose authority it was put into the report. Alderman Stocks said he should be prepared to answer the question when the subject came before the Committee. Alderman Glendinning inquired where the authority was for the expenditure. Alderman Stocks said the authority was for the printing of a lecture; and he supposed the Gas Manager had taken it as an authority for the printing of other matter also. Considerable conversational discussion ensued, in the course of which Alderman Hirst said he did not believe in the Corporation puffing something which had not been fully tried. He complained that the gas had recently been very poor. He should oppose the sanction of the Corporation being given to the printing of the report; and he would move that the whole matter be referred back to the Committee for re-consideration. It was pointed out, however, that this could not be done; and eventually the proceedings of the Committee were confirmed, except in respect to the printing of the report alluded to.

Tilehurst, Pangbourne, and District Water Company, Limited.—A Company has been formed under this title, with a capital of £30,000, in £10 shares, to supply water in Tilehurst and several other places in Berkshire.

Failure of the Electric Light at the Mansion House.—We learn from the *City Press* that, on the occasion of the entertainment given at the Mansion House by the Lord Mayor, to the leading inhabitants of his ward and a numerous company, on the evening of the 21st ult., "not a little inconvenience was experienced during dinner through the electric light going out." Our contemporary adds: "Fortunately, gas was being used as well, or the company would have been cast into Cimmerian darkness. The electric light appeared again after the lapse of about twenty minutes."

THE USE OF COAL GAS FOR DOMESTIC PURPOSES OTHER THAN LIGHTING.

The current number of *Hygiene* contains the following article on the above subject, which we have reason to believe is from the pen of Mr. Thomas Fletcher, F.C.S., of Warrington:—

This subject is one which requires consideration from many points of view. As the comparative cost of coal and gas for heating purposes is an element of importance, and as prices vary so greatly, it will be the simplest method to adopt a standard price for both, which will admit of easy calculation for the varying prices of the two fuels. Taking coal at 17s. per ton, we get 11 lbs. weight for 1d.; and taking gas at 3s. 4d. per 1000 cubic feet, we get 25 cubic feet for 1d. Now, 20 cubic feet of London gas (16-candle) have a theoretical heating power equal to 1 lb. of good coal; so that, at the comparative prices given, gas is nearly nine times the cost of coal, provided both fuels could be burnt with equal economy, which is far from being the case on the small scale required for ordinary domestic use. Where the work is small and intermittent (such as cooking, bedroom fires, and bath-heating), gas comes out in practice far the cheaper fuel; but where the work is fairly regular (such as the heating of ordinary living rooms by open fires), the cost of gas averages in practice about three times that of coal. Of course, by the use of warm-air arrangements combined with a gas-fire, the cost may be reduced quite 50 per cent.; and the same economy may be practised with coal or coke, by using coke-stoves, but for the fact that they are very unpopular in this country—rooms heated by air-warming arrangements being comparatively close and "stuffy." This feeling is caused by the upper part of the air being warmer than that near the floor; the practical result being that, in rooms heated in this manner, it is difficult to keep the feet warm, even with the thickest carpets.

One of the commonest fallacies with regard to gas is the idea that a given quantity of it burnt in a common lighting-burner gives less heat than if consumed in a Bunsen or atmospheric burner. This is entirely a mistake. Gas, whether consumed in a common lighting-burner, a regenerative lamp, a Bunsen or atmospheric flame, or a blowpipe or furnace, gives, if properly burnt, absolutely the same quantity of heat for the same amount of gas under any and every condition; the only difference being in the concentration, or the convenience of its application for any special purpose. For instance, if a large air space has to be warmed by burning gas in it, it is a matter of absolute indifference whether we use common lighting jets, regenerative lamps, atmospheric burners, blowpipes, or blast-furnaces. The result is exactly the same in each case if the air is kept in circulation. For every cubic foot of London 16-candle gas burnt, we get a heat of 660 units—*i.e.*, a heat which, if perfectly utilized, would raise the temperature of 660 lbs. of water 1° Fahr. In the large air space under consideration, we should, with any of the methods of burning, obtain the whole of the heat in useful work; but if we wanted (say) to melt 1 lb. of cast iron, the only method by which any useful work could be obtained would be in a blast gas-furnace, where the whole of the heat can be concentrated rapidly on one spot. This explains why, under ordinary circumstances, an atmospheric burner is so much more efficient than a lighting burner for boiling water. The heat from the atmospheric burner can be localized and concentrated on the work required, and less is lost in the surrounding air.

Having now settled a basis on which the results may be compared, and explained some of the sources of possible error, we may consider the various purposes to which gas may be advantageously applied for domestic use, and the points which require attention to prevent failure and annoyance.

Domestic Cookery.—Under ordinary circumstances, the whole of the products of combustion come into the kitchen. They are in themselves free from odour, and no nuisance in any way; but they may easily become a very serious annoyance if some simple points are neglected. The stench and nuisance of cooking by a coal-fire is inappreciable from the simple fact that the whole goes up the chimney. If the same nuisance were to appear with gas cookery, it would be intolerable in any house; and to prevent this certain points are essential. The burners must be clean, and must burn with a clear greenish-blue flame; the vessels must be clean outside; a pan used on a coal-fire and then placed on a gas-burner will make a suffocating smell through the house, owing to the tarry matters deposited on the vessel by the imperfect combustion of the coal. Pans, &c., containing fatty matters must not be allowed to boil over on the burner, as the smell of charred fat, or any animal or vegetable matter, is most offensive. For similar reasons, roasting tins must never be placed above a gas-flame, either in an oven or over a boiling-burner. If perfect sweetness in the kitchen is required, the use of the frying-pan must be prohibited, as the smell from frying is always unpleasant; it is quite unnecessary, as the work can be done far better by a gas-grill. Fried food is indigestible and cheap; but the cheapness does not compensate for its indigestibility.

We now consider the cost. Taking an ordinary gas cooking-range, such as is usually hired out by the gas companies, the expense depends largely on the care and supervision exercised; and to demonstrate this, I will give two extreme cases, the results of which have been carefully taken, and may be depended upon as being fair examples. The first is one of a small and careful household, where close supervision is constantly exercised; the other is that of a household conducted on a liberal scale, under the control of a good *chef*, where everything is done in the most perfect manner. The average may be taken between these. "Cooking regularly for six persons and boiling water for general purposes, no fire in the house during the summer months; gas 2s. 4d. per 1000 cubic feet. Total cost of twelve months' cooking, £1 2s. 7d." This is extraordinarily low in cost, and is a rate which will rarely be reached. The other case is equally clear on the opposite side. "From the 4th of January, 1888, to the 2nd of July, 1889, cooking for ten persons, the total gas consumption was 41,700 cubic feet, which, at 2s. 3d. per 1000, amounts to £4 13s. 9d., or 5s. 2½d. per month. The average consumption of coals in the fire-range before using gas was one ton per month, costing 20s." These are actual cases in practice, not estimates; but it is quite evident that, even in the latter one, no actual waste of gas has been permitted, and that the furious boiling over and general burning of things by extravagant and unchecked gas consumption have not existed.

It is a curious fact that roasting, which is always a costly process before an open fire, is the cheapest process carried on by gas, as the average gas consumption per pound of meat roasted in ten different gas cooking-ranges, by different makers, did not exceed 3 cubic feet of gas per pound of meat roasted; the lowest being 2 cubic feet, and the highest 4⅛ cubic feet per pound of meat. This difference was caused almost entirely by the different sizes of the ovens used; the cost being ruled by the size of the ovens, rather than by the weight of meat roasted. With gas at 25 cubic feet for 1d., the cost of boiling averages 1d. for every 5 gallons of water boiled in ordinary broad-bottomed pans or kettles. The cost of grilling is, taking the average of a number of tests, almost exactly double that of roasting; whereas frying—the cheapest of all methods—costs considerably less than roasting the same weight of meat, although there are no statistics available from which average results can be obtained.

It may be taken as an absolute rule, without any exception, that gas cooking can always be done in an ordinary kitchen without special ventilation, and without any offensive smell; and where any exists, it is a sign of either waste, dirt, or carelessness. As to its popularity, this may be estimated by the fact that one English gas company has out on hire, at the present time, over 60,000 appliances for cooking and heating—at least one-half of these being for cooking purposes only.

Bath Heating by Gas.—This is a subject which requires very much more attention than has been given to it. The modern fashion of extreme speed of heating entails conditions which are not always possible; and when these are neglected or overlooked, a very distinct element of danger appears. This has been proved by several fatal accidents, if they may be classed as accidents. With the best apparatus which can be made, a 30-gallon bath cannot be heated with a consumption of less than 30 cubic feet of gas. This will require at least 300 cubic feet of air to consume it; and the resulting 330 cubic feet of burnt air and gas will render fully 3000 cubic feet of air totally unfit for respiration. If the heating is done in 15 minutes in a bath-room 10 feet square, the whole of the air in the room becomes quite unfit for respiration in five minutes; and the only possible remedy is to connect the heater with a reliable flue, which can be absolutely depended upon as being free from risk of down-draught. This is by no means a simple matter in most places where no flue exists near the bath-room; and although there are some methods by which the deficiency may be overcome, these, like many house chimneys, are not always successful, owing to local conditions and peculiarities. The only safe way to fix a rapid or instantaneous bath-heater is to put the whole matter in the hands of an experienced fitter, and make him responsible for the success or failure. A man who thoroughly understands this class of work will know at once the difficulties; but, of course, such a man is not likely to be the cheapest. In the absence of an absolute guarantee from the fitter, it may be taken as a rule, without any exception, that a bath-heater which will heat an ordinary full-sized bath in the usual small bath-room is unsafe if it will do the work in less than from an hour and a half to two hours; and this, for ordinary domestic use, is quite quick enough. To quote the saying of a friend, "People do not, as a rule, get dirty so quickly as to require a bath oftener than every two hours." With regard to rapid bath-heating, fashion is very well in its way; but it is not policy to risk life for the sake of fashion, when circumstances are against safety. Bearing on this question, it must be remembered that rapid heaters in which the gas is burnt in ordinary illuminating flames are quite as dangerous without a good flue as any other form, although many makers, who should know better, assert the contrary. The rapid combustion of a large quantity of gas must of necessity remove oxygen from the air; and, as a matter of fact, in a small close bath-room the burner of a large rapid bath-heater would remove the oxygen so rapidly from the air that it would extinguish itself, and for this reason the products of combustion must be removed. This does not apply to slow-working heaters with a small rate of gas consumption, as the natural diffusion which always takes place is sufficient to render this harmless.

Gas Fires and Stoves for the Sick-Room.—These, to be satisfactory, require to be different from the ordinary gas-fires in living-rooms. In a sick-room, it is necessary that the temperature shall be kept steady, the fire at times requiring to be turned very low. This, in the usual pattern of iron fret, or hollow ball fires, is not possible, as neither of these forms can be always depended upon to work at less than half their normal power; and to make these suitable for sick-rooms, it is necessary to divide the burner into two or more parts with separate taps, which is an undesirable and expensive complication, liable to cause trouble in unskilled hands.

We may consider that for sick-room use the following conditions must have the first attention: (1) Great range of power, down to the lowest, without risk of lighting back at the jet. (2) Comparative silence. (3) Absence of strong light. (4) The power to use a bronchitis kettle or steaming arrangement when needed. To fill the whole of these conditions, it is necessary to have a fire surface of fibrous asbestos on a flat brick; the burner having much smaller holes than are necessary for the iron fret or hollow ball fires. Where the temperature of the air of the room is important, the fire should, for economy's sake, have an air-warming arrangement combined with it; and, for steaming, either a boiling-burner attached as a trivet to the fire, or a separate boiling-burner placed on the hearth—the latter being perhaps the best, as the kettle can be brought well forward into the room. An exceedingly good substitute for a bronchitis kettle is a blanket or heavy bath-towel wetted and hung before the fire. Except in affections of the lungs, warm air in a bedroom is objectionable to most; and a simple source of radiant heat is by far the most agreeable. All air-warming arrangements have the same objection as hot-water pipes; they cause a feeling of "stuffiness," which is intensely disagreeable to many people.

With regard to noise, all atmospheric flames cause more or less sound, and, unfortunately, all taps have the same defect. Some are excessively noisy; and the sound, travelling along the tube, appears to come from the gas-burner—exaggerating a defect which is in itself not usually great. The best method of reducing the sound is to use a good gas-governor on the main supply, so as to prevent excessive pressure.

Many extraordinary statements as to the cost of gas-fires have been made; not one of them being based on any actual results, or giving any basis to calculate from. The mistake is that the calculations have been made from the air space to be heated. The absorption of heat by the air varies enormously according to the moisture held in suspension; but, under any circumstances, it may be quite ignored as a basis on which calculations must be made for heating rooms of different shapes. The heat is almost entirely expended on heating the walls of a room. They appear to have an unlimited capacity for the absorption of heat; and the calculation must be made from the wall surface—the following rules being the result of repeated trials on both a large and a small scale under varying conditions.

We will take first the cheapest possible form of gas heating, flueless stoves, and limiting the ventilation. This system is suited only for beer-cellars and stores, and is given as a standard of reference for the greatest available duty for the fuel used. Rule for finding the gas consumption required to obtain any exact temperature: For every 1200 square feet of wall surface (excluding ceilings and floors), a consumption of 1 cubic foot of gas per hour is required for every 1° Fahr. rise of temperature. Example: A room without flue, kept close, and badly ventilated, size 30 ft. by 30 ft., and 10 ft. high, would require a gas consumption of 20 cubic feet per hour to raise the temperature 20° Fahr.

The figures given are for continuous heating, night and day—*i.e.*, for retaining a given temperature after it has been obtained. The actual heating-up of the room and walls is a comparatively slow process, and depends on the speed required. It may be taken as a rule that, for heating-up a room which has been allowed to cool, at least double the consumption will be required for the first three or four hours. If the products of combustion are carried away, and the room is fairly ventilated, the gas consumption will average nearly double this; and it may be taken as a safe rule for a gas-fire and air-warming arrangement, that a well-ventilated room will require, for every 600 square feet of wall surface, 1 cubic foot of gas per hour for every 1° Fahr. average rise of temperature. Where a fire alone is used as a source of radiant heat, the temperature of the air varies so greatly that exact experiments are impossible; the air only becoming warm as the radiant heat is absorbed by the walls and solid contents of the room, so that it cannot be considered as an air warmer. The cost given above will apply also in living-rooms, except when a gas-fire is built up in an ordinary coal-fire grate. This, owing to its backward position and its surroundings, is a most costly luxury, and can only be adopted when expense is no object. It is a most popular form of fire; and its use is rapidly extending, in spite of the extravagant cost. But, of course, when used in drawing-rooms for short periods, the expense is a very secondary matter compared with convenience and absence of dirt.

With regard to condensing stoves (or "syphon" stoves as they are sometimes called), their power is very small for their size and cost; and the largest are only suited for very small rooms. It is the custom of most makers to hide the outlet for the products of combustion; and this has led to a general belief that all the products of combustion are condensed. This is not the case. Only the sulphur compounds and the water of combustion are condensed; and the carbonic acid escapes into the room. Its presence may readily be detected by analysis of the air; but as it is quite inert, the only effect is to reduce the percentage of oxygen in the room, and to cause, to a certain extent, the "close" feeling which is produced by all flueless stoves. Carbonic acid evolved in the breath is known to be both offensive and dangerous in confined places; but this is only on account of the germs and volatile organic matters with which it is contaminated.

The advantages of the use of gas as a fuel are not only great, but many of them are simply unapproachable by any other fuel. In the sick-room we can not only get warmth, but we can get precisely the kind and the quantity we require, dry or moist, convected or radiant, as needed. The warming of food, and other matters for sick-room and nursery use, is simple, quick, and certain, night and day; and the disturbance of restless patients and children is avoided. In the preparation of food, the perfection of the result, and the absence of burning and waste, irrespective of the economy in labour and expense, are quite sufficient to put gas in the front rank. With proper arrangements, bath-heating can be done by gas in a way which is simply impossible with any other fuel. At the same time, we must not expect special miracles; and those who look for a down-draught in a chimney to be cured by the use of a gas-fire, will always be doomed to disappointment.

THE LONDON COUNTY COUNCIL AND THE METROPOLITAN WATER SUPPLY.

The Council's Water Bill.

The following is the text of the Bill which the London County Council have decided to introduce next session to enable them to acquire lands and water rights, with the view of affording a supply of water to London and the neighbourhood:—

Whereas under the London Water Act, 1892, the London County Council have power to introduce Bills relating to the supply of water in the Administrative County of London and within the limits of supply of the Metropolitan Water Companies; and whereas some of the areas in Great Britain best adapted for sources of water supply have been already appropriated under the authority of Parliament by the municipal authorities of the principal cities and towns, and powers for the appropriation of further areas have been from time to time granted, and are from time to time applied for on behalf of other populous and increasing places; and whereas it appears that the means for the supply of water to London and the neighbourhood are inadequate, and that larger quantities of water than can now be legally obtained are required for that supply, and that, if the Rivers Thames and Lea are to be relied upon for the future water supply of London, considerable additions are necessary to the arrangements for storeage, filtration, and purification; and whereas it is estimated, in view of the probable increase in the population of London and the neighbourhood, that the existing sources of supply might at no distant period become inadequate, while the increasing population in the valleys of those rivers will render it increasingly difficult to maintain their water sufficiently pure and wholesome for drinking purposes; and whereas it is expedient that powers should be conferred on the Council under which, as occasion may offer, the Council may have power to purchase land and water rights which they may think it desirable to secure with a view to the future supply of water for London and the neighbourhood. Be it therefore enacted as follows: 1.—This Act may be cited as "The London County Council (Water) Act, 1894." 2.—It shall be lawful for the Council to purchase by agreement or take on lease (1) any lands, houses and buildings, or easements, and (2) any water-works, wells, waters, or rights to take or convey water which the Council may think it desirable to purchase or take on lease with a view to the future supply of water to London and the neighbourhood. 3.—It shall be lawful for the Council to hold and manage any such lands, and from time to time to let such lands, works, or rights, or any of them, on lease or otherwise, and to sell or exchange any of such lands.

THE GLOUCESTER CORPORATION WATER BILL.

A Public Meeting of the owners and ratepayers of Gloucester was held last Thursday week—the Mayor (Mr. J. A. Matthews) presiding—to consider the expediency of consenting to the promotion, by the City Council, of a Bill to empower them to construct additional water-works, and for other purposes. The proceedings commenced by the Town Clerk reading an exhaustive report which he had prepared upon the water question. He traced the history of the water supply from 1854, when Mr. Bateman was consulted by the Corporation, and reported upon three schemes, one of which—the Witcombe—was ultimately adopted. Since then, he said, several improvements had been made in the system; but in 1890, the Corporation had strong evidence that they must immediately seek for an additional source of supply. In the following year, Mr. W. Fox, C.E., was consulted; and he submitted a number of reports on the existing supply, and fresh projects—the one recommended by him being the pumping of water from the red sandstone near Newent. In 1892, the whole of the reports were laid before Mr. James Mansergh, who stated that he had come "somewhat reluctantly" to the conclusion that of all the schemes the Newent was the one which should receive further attention. Professor Frankland reported favourably as to the quality of the water; and Professors Etheridge and Lapworth were consulted as to the geological questions involved. These experts advised that, under ordinary circumstances, from 500,000 to 600,000 gallons of water a day might be expected from a pumping-station at Newent. The Mayor, in moving a resolution consenting to the promotion of the Bill, pointed out that the average quantity of water consumed daily in Gloucester per head was 14·683 gallons; in Barrow-in-Furness, 33·205; Huddersfield, 24·755; Reading, 31·799; Shrewsbury, 37·037; and Birmingham, 29·373. Then with respect to loan indebtedness, the amount per head of the population for Gloucester was £1 6s. 8d.; while at Batley the sum was about £11; Cheltenham, about £7 10s.; and Manchester, nearly £5. It would be seen that Gloucester compared very favourably with those places. As to what the Corporation were charging the citizens for their supply, he mentioned that the present water-works had been a source of profit to the city; the Corporation having in one year carried forward something like £3000 in relief of the rates. Last year they carried forward as much as £1500; and had it not been for the extra expenses and excessively dry weather, probably they would have carried forward a similar sum or more this year. Notwithstanding those facts, the Corporation had been supplying the citizens at the rate of 10d. per 1000 gallons; while Cheltenham charged 1s. 2½d., and other towns much more. He thought these figures showed that they were not so badly situated in Gloucester as many other towns were. The motion having been seconded, considerable discussion followed; but in the end the resolution was carried by an overwhelming majority.

Explosions of Gas.—What is popularly termed the "festive season" has unfortunately been attended with several explosions of gas—one unhappily with fatal results. On the evening of the 23rd ult., an explosion occurred at the Fox under the Hill public-house, Denmark Hill, which wrecked the back bar and generally shook the house. Three men were burnt—two so badly as to necessitate their removal to the hospital; and the contents of the premises were much damaged. On the same evening, an explosion of gas took plaee in Kells parish church. All along the side the floor was torn up and the pews were shattered, and fragments were hurled against the ceiling. The choir were practising at the time, but escaped serious injury. It is stated that a leakage of gas had been discovered, and workmen were engaged to repair it. The damage is estimated at £1000. Shortly before five o'clock last Wednesday evening, a serious explosion occurred at 20, West Street, Croydon. Mrs. Coltman, the occupier, went with a light into a room into which gas had been escaping; and the result was an explosion which practically wrecked the house. Lillie Coltman, aged 39, and Josephine Coltman, aged nine, were severely burned, The damage is estimated at £200. The same day an explosion of gas took place at Crompton Hall, Shaw, near Oldham, the residence of Mr, J. H. Lees Milne, J.P., caused by an escape from a chandelier. The family were away from home at the time; but the caretakers—Mr. and Mrs. Dell—were injured, the former so seriously that he died on Thursday night. Considerable damage was done to the property. Two explosions happened in London within a short time of each other last Friday. The first occurred at a quarter to twelve, at 69, Usher Road, Old Ford, E., on the premises of Mr. W. Baker, hairdresser. The shop and passage on the ground floor were wrecked, the rest of the premises sustained considerable damage, and William Baker, aged 25, was burnt on the head and face. The second explosion occurred at 216, New North Road, N., on the premises of Mr. J. Austin, boot manufacturer. The back workshops and the back room on the ground floor were badly damaged by fire and explosion; and John Austin, aged 46, was burnt on the face and hands.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This is the season when notices of the past year are as common as blackberries in autumn. Within my sphere, there is little to record. The year has been one of quiet work, with little incident. Extensions of gas-works have been carried out in Glasgow and Inverness. In the case of Glasgow, besides a large increase in the productive and purifying plant, there was brought into use, in the early autumn, the new six-million cubic feet gasholder, which is the largest in Scotland. A more notable feature was the introduction of the Arrol-Foulis stoking machinery, which was described in the JOURNAL on Sept. 27, 1892, and April 18 last, and which, it is stated, is working up to expectation. In Inverness, the extensions were of the ordinary sort, including a new gasholder of larger dimensions. Mr. Alex. Smith, of Aberdeen, is at present engaged in the construction of a 4-million cubic feet gasholder, which will be the second largest holder in Scotland, and which will place the storeage capacity of the Aberdeen Corporation Gas-Works upon a satisfactory footing for a number of years to come. A satisfactory feature of the year has been the general lowering of the charge for gas, consequent upon the fall in the price of coal; the reductions varying from 3d. to, in most cases, 5d. per 1000 cubic feet. Another prominent feature has been the rapid extension of the Young and Bell process for producing oil gas for enrichment purposes. Though only a little more than a year old, it has already been adopted in Galashiels, Alloa, Kelso, Penicuik, Musselburgh, Perth, Stirling, Dumfries, and other places both in Scotland and England. I met one of the patentees the other day; and he informed me that from all the places where it has been brought into use there came the most satisfactory accounts of the working of the plant. Neither water gas nor any of the carburetting processes have obtained a foothold in Scotland. The North British Water-Gas Syndicate still maintain an establishment at Uddingston; but they have not been able to get their system introduced into any public works, and there has certainly been no effort made to apply the gas for lighting purposes. At present, the Syndicate are, much against the will of a minority of the shareholders, being amalgamated with similar bodies in England, with a view to consolidating their interests; and the promoters have not yet given up hope of being able to get a share of gas-producing business.

Electric lighting, so far as public business is concerned, has not advanced very much. In Glasgow and Dundee the Corporations have started installations, both of which are said to be doing well; but the latter is as yet very small. The Corporation of Aberdeen have nearly completed an installation, which is a little ambitious in character, and which is expected to be opened in the spring of 1894. The Edinburgh Corporation are very tardily taking the matter up; and their proposals are of a still more ambitious character. Coatbridge is about to be lighted by electricity supplied by a Company. In no other town has any public electric lighting work been done during the year; but the village of West Calder was two or three months ago lighted by current which is supplied gratis by the local co-operative society—certainly a curious arrangement.

During the year, the sulphate of ammonia market has taken a turn which is most gratifying to all connected with gas-works; the price having risen from between £9 and £10 to £13 10s. per ton. There is the more satisfaction in this improvement, in that it has been effected notwithstanding a very great increase in the production of sulphate of ammonia in connection with iron-works.

The year has not seen any considerable movement in connection with water-works. The Corporation of Glasgow have continued their works for the augmentation of their supply from Loch Katrine. The Edinburgh and District Water Trust are still pursuing the subject of obtaining an additional supply for their district; but they have not yet made up their minds as to where they are to take it from, and the subject has been hung up for another year. The Aberdeen Corporation have obtained power to improve their water supply by the construction of extra reservoirs and filter-beds; but they have not agreed upon the plans for their proposed works.

The obituary for the year contains the names of Mr. W. Mackenzie, of Dunfermline, the first Secretary of the North British Association of Gas Managers; Mr. Laurence Hislop, of Uddingston and Bothwell, a gentleman well known in gas circles; Mr. R. B. H. Thomson, of Broughty Ferry, a young man of great promise; and Mr. Alexander Leslie, C.E., of Edinburgh, one of the Engineers to the Edinburgh and District Water Trust.

The upheaval resulting from the recent municipal election is beginning to tell upon the work of the Edinburgh and Leith Gas Commissioners. It is one of the drawbacks to the municipal management of such undertakings, that so frequent changes are made in the *personnel* of the governing body. Every advent of new members means that their older colleagues have to start the work of educating the new-comers. The misfortune is that the education has to go on to a large extent in public; and if the new-comer be stiff-necked, or otherwise intractable, the process is so much the more protracted. Some never do get educated, but serve their term and leave the Commission without knowing much of the business they were sent there to transact. I am moved to these reflections by one or two incidents at a short meeting of the Commissioners on Monday; not that the new-comers were prominent in them, but that some of the older members, affected probably by a desire to show off before the new arrivals, indulged in expressions which were not in the least edifying. I was sorry, for instance, to see such a sensible gentleman as Mr. H. W. Hunter raise a trifling question about the distribution of contracts for meters among the manufacturers. In his opinion, these should be divided equally; and it was next to impossible to convince him that, though that might be the desire of the Commissioners, it was scarcely possible to do it in practice with exactitude. For example, Bailie Archibald said, one maker might employ fifty men and another ten; and what, in that case, would be an equal distribution? But the whole point was taken out of the subject by Mr. Linton's explanation that what Mr. Hunter desired was done as nearly as possible. Then the Commissioners took up an application by the Superintendent of the Surveyors for an increase of salary, which was certainly a matter for inquiry by a Committee; but a little talking to the gallery took place before the remit could be made, which will possibly result in further applications coming in. In fact, I understand that the whole of the surveying staff (which numbers 39) have already sent in, or are about to send in, applications. The next item of business was an extraordinary letter from the Cleaning and Lighting Committee of the Edinburgh Town Council, asking if the Commissioners would collect the amount charged for gas consumed in common-stairs and the cost of extinguishing the lights, in the event of the Corporation undertaking that work. The proposal is made in order to save the Corporation the cost of a department for doing the work; but it seems to me to be a strange one. There were several statements in the course of the discussion on this subject of a not very high order; and ultimately the Commissioners arrived at the resolution to do nothing in the matter. To that end, Mr. Kinloch Anderson greatly helped by opportunely pointing out that, when the Commissioners last February offered to supply gas at a certain price, the proposal was based upon the notion that the city were to collect the money, and pay them by cheque; and that, if the Commissioners were to be made the collectors, the charge for gas would probably have to be raised.

The mechanics in the employ of the Edinburgh and Leith Gas Commission in the Edinburgh works, held their annual supper on the evening of Saturday last, in the Café Royal Hotel. There was a goodly gathering, presided over by Mr. D. Alexander, the genial and obliging Sub-Manager. Unfortunately, Mr. R. Mitchell, the Engineer, whose health is again not very good, was unable to be present. I have received, through the kindness of the Secretary, a copy of the programme of musical and other items of entertainment which followed the supper. They were all given by employees; and really a very high-class affair it must have been, showing that the Commissioners are fortunate in possessing a staff of men of high intelligence, who are worthy of every encouragement.

Another explosion in an electric lighting conduit occurred in Glasgow, in St. Vincent Street and Renfield Street, on Tuesday night. It took place at about eleven o'clock, when there were not many people about. It is impossible to get an accurate description of what actually happened. Passers-by heard a loud noise, and saw flame ascending for about 3 feet into the air from the manholes in the conduits at the west corners of the above streets. Some of the witnesses describe the fire as being merely sparks; and others as being a bluish flame. No one was directly injured by the explosion; but a lady afterwards stumbled over one of the displaced covers, and had her face cut by her fall, As was the case when the former explosions occurred, the electric lighting officials throw the cause of the mishap upon the gas; and this time they do so with greater force, in respect that nothing was found to be wrong with their mains. Be that as it may, the mystery is not explained by them; and more especially as it is stated that, at the time the explosion occurred, the arc lamps in George Square nearly went out, and blinked badly for a hour or so after, It is reported that in future an endeavour is to be made, in relaying gas mains, to keep them as far away from the electric light mains as possible. This would be but a poor remedy, as the gas-mains may not be re-laid in most of the streets for many years. Some other means must be taken to prevent the disturbances.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 30.

Sulphate of Ammonia.—There has been a further decline; but, on the whole, the market may be said to be fairly steady. At all events, buyers have been found for all the parcels offering; and the quantity in the market was not large. The holiday feeling prevailing has kept a good many orders out of the market, which will probably come in next week. Values are not now expected to go any lower.

LONDON, *Dec.* 30.

Tar Products.—The holidays have interfered very much with new business; but shipments on old contracts are being made in large volume. Generally speaking, however, prices are lower; and makers are now more anxious to sell—production at the moment being extremely large. Creosote and common oils are in request for illuminating purposes. This outlet is becoming a very useful one to distillers, coming as it does at the very time when large quantities are being made, and when the temperature makes it possible to separate salts from the liquid oil. Carbolic and cresylic acid are keeping in demand; but buyers hesitate about paying the advanced price ordered by the Tar Products Committee. The "knowing ones" are again prophesying that 90 per cent. benzol will touch 1s. per gallon. It is some distance from that figure at present, when the make is much larger than at any other time of the year; and with the improved prospects of aniline oil, it is doubtful if the price will go any lower, while the demand for 50's is distinctly maintained. Prices nominally are as follows: Tar, 15s. to 16s. Pitch, 27s. to 28s. 6d. Benzol, 90's, 1s. 5d.; 50's, 1s. 6d. Creosote, 1¼d. Creosote salts, 25s. Solvent naphtha, 1s. 4d. Toluol, 1s. 8d. Crude benzol naphtha, 30 per cent., 8d. Carbolic acid, 60's, 1s. 8d.; crystals, 6d. Cresol, 1s. 4d. Anthracene, 30 per cent., "A," 1s. 1d.; "B," 9d.

Sulphate of Ammonia.—A remarkable simultaneous cessation of demand in all quarters points to a combined operation to reduce the price, which, it is hoped, makers will counteract by withholding from offering in the meantime. Continental consumers require all that is made; and there is no reason for any reduction in value. Urgent sellers, however, have accepted as low as £13 5s.; and during the week the price seems to have oscillated between that figure and £13 7s. 6d., less 3½ per cent. Gas liquor is quoted at 8s. to 9s.

Cardiff Corporation Bill.—In their newly-deposited Bill, the Cardiff Corporation estimate the cost of the additional water-works which they seek power to construct at £200,000.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The prominent feature in the coal trade of Lancashire in the past year was, of course, the struggle between the Miners' and Coalowners' Federations, with regard to wages, which was virtually commenced early in the year, by the renewed agitation for a general stoppage, similar to the disastrous expedient in 1892. Although this was not sanctioned by the General Conference of the Miners' Federation, it created for the time a complete disorganization of the markets, and was followed soon after by a movement among the coalowners for a reduction in wages; definite steps in this direction being only kept back until the end of July owing to the want of co-operation on the part of the coalowners in Yorkshire. The year opened with a generally steady tone as regards all the better qualities of round coal. Best Wigan Arley was firm at 12s. 6d. to 13s.; Pemberton four-feet, at 10s. 6d.; and common house-fire coals, about 8s. 6d. to 9s. per ton at the pit mouth. The exceptional mildness of the season, however, caused a very restricted demand, and a large accumulation of stocks on the pit banks, although pits in many cases during the summer were barely working half time. Prices steadily receded—house coals giving way about 1s. per ton; but this did not at all represent the falling off, so far as the lower qualities of round coal were concerned. Owing to the depressed condition of the principal coal-using industries, common round coal became a complete drug in the market; and from being quoted at about 7s. 6d. at the commencement of the year, it went down to as low as 6s. per ton at the pit mouth, while the excessive supplies caused an extremely keen competition for contracts for gas-making coals and locomotive fuel. Gas-coal contracts were generally placed at quite 1s. to 1s. 6d. per ton under the prices obtained in the previous season; and for locomotive fuel, contracts were accepted at as low as 6s. 3d. to 6s. 6d. per ton at the pit mouth. The absence of demand for round coal necessarily had the effect of restricting the production of slack; and engine fuel gradually hardened up in price in consequence. Common slack, which at the commencement of the year could be bought readily at 3s. to 3s. 6d., rose to 4s. 6d. and 5s.; the better qualities, from 4s. 9d. and 5s. up to 6s. 6d.; and burgy, from 6s. 3d. and 6s. 6d. up to 7s. and upwards per ton at the pit mouth. With the coal stoppage, which, from the end of July, extended until nearly the close of the year, prices, of course, for the time being went up to all sorts of abnormal figures. With the resumption of work at the pits, a fairly substantial advance has since been maintained of about 2s. 6d. per ton, on the better qualities of round coal, 4s. to 5s. upon steam and forge coals, and about 1s. to 1s. 6d. per ton upon engine fuel, as compared with the minimum prices that were being taken prior to the commencement of the dispute; and the year has closed not only with a very firm tone at the full quoted rates, but in many cases with a tendency to harden up still further. The new year stoppages of the pits, which in most cases extend from Friday evening last until to-morrow (Wednesday) or Thursday, are, of course, interfering with business in the coal trade of this district. Colliery proprietors have already a great pressure of orders on their books, especially for the better qualities of round coal; and as there are no stocks whatever to fall back upon, even this temporary stoppage of the pits will make itself seriously felt as regards supplies which consumers will be able to obtain. The chief demand continues to be for house-fire consumption; but all other descriptions of fuel, except some of the very inferior sorts of slack, also meet with an active inquiry, which is in excess of the supplies that coalowners have at present at their disposal. Prices continue exceedingly firm, at the full rates quoted last month, with, in some cases, an advance of 6d. per ton put on for anything like early specified delivery. At a largely attended meeting of representatives of the principal colliery concerns throughout the district, held on Wednesday at Wigan, it was decided that no change whatever should be made in quotations—the demand fully warranting these being maintained. At the meeting, further progress was also made towards establishing the Coal Sales Association, which is being formed largely with the object of enabling colliery proprietors to protect themselves against undue competition, with regard to the large contracts which usually come out during the summer. Mr. T. R. Ellis, the Secretary of the Federated Coal-owners' Association, was appointed Secretary also of the Coal Sales Association. At the pit mouth, best Wigan Arley coals are not quoted under 14s. 6d. to 15s., with 15s. 6d. asked in some cases; second qualities of Arley and Pemberton four-feet remain firm at 13s. to 13s. 6d.; with common house coal ranging from 11s. 6d. up to 12s. 6d. per ton. The lower qualities of round coal, for steam and forge purposes, are very stiff at recent rates, with rather a hardening tendency. The lowest figure now ruling is 10s. 6d. to 11s. for inland coal; while for shipment, nothing under 12s. 9d. to 13s. is being quoted for delivery at the Garston Docks or the High Level, Liverpool; and collieries in many instances are unable to entertain orders even at these figures. The better qualities of engine fuel are firm at 8s. up to 9s. for burgy, and 6s. 6d. to 7s. 3d. for slack; but inferior sorts of slack are obtainable at about 5s. to 5s. 6d. per ton—these being rather weak, owing to competition from outside districts.

Northern Coal Trade.—The interruption that the holidays have caused to the production of coal, has been rather marked; but it had been anticipated by very heavy shipments in advance, and the mild weather has lessened the drain on the stocks that had accumulated. There is now much more negotiation as to the rates that will rule under the contracts for the supplies for the whole of the new year; and coalowners are inclined to take more moderate views of the position of the trade. It is seen that, with all the districts at work, the output of coal must soon meet all the requirements of users; and when the consumption falls off with the lengthening days, it will more than do so, unless there should be strikes. But buyers of coal have had generally to pay slight advances; and it may be looked on as probable that some addition to the cost will take place in the cases of all the contracts that are made for some time ahead. Best Northumbrian steam coals have been freely sold for delivery over a considerable part of January at about 12s. 6d. to 13s. per ton f.o.b., which is lower than the prices that have ruled of late, because the uncontracted coal is larger in quantity. For delivery forward over the year, prices rule downwards to about 10s. 6d. per ton f.o.b. Small steam coal is weaker; and the current price is now from 4s. 6d. to 5s. per ton. Manufacturing coal is also dearer for the year's requirements; and the prices generally quoted may be put as from 6d. to 9d. per ton above the rates that were paid for the year 1893. In gas coals, great variety of opinion prevails as to the prices that are likely to be charged; but the best test is that reported last week—the allotment of the bulk of the contact for the supply of the Newcastle and Gateshead Gas Company at just 7s. 9d. per ton delivered—an advance on the rates of the expiring contracts. Generally, then, fuel is dearer for the new year; but the changes that time will bring can only determine the prices that odd lots free from contracts will attain. Coke is very steady at about 16s. per ton f.o.b., with a good demand that may be locally increased. Gas coke is very steady; the shipments and the local demand having kept down stocks. Prices of gas coke will be higher for manufacturing purposes for the new year.

Scotch Coal Trade.—The demand continues good in Scotland, particularly for ell and splint varieties, for delivery during 1894. Prices have not yet receded to what they were before the recent troubles. Quotations may be given as: Main, 10s.; ell, 11s.; splint, 9s. 9d.; and steam, 11s. per ton—all f.o.b. Glasgow. A year ago they were: Main, 7s.; ell, 7s. 9d.; splint, 7s. 9d.; and steam, 9s. A writer in the *Dundee Advertiser* calculates the cost of the late strike in the West of Scotland at £775,080, of which £414,140 was loss of wages, and £360,940 loss of profits and capital. Except that the holidays are on just now, the men are working willingly. In Fifeshire, they are grumbling at the refusal of an advance; but it is expected that they will await future developments before resolving upon any action they may take. The shipments for the week amounted to 174,415 tons—an increase of 44,706 tons over the preceding week, and of 19,592 tons over the corresponding week of the previous year. For the year, the total shipments have been 7,618,075 tons—an increase of 79,505 tons over the year 1892.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 16.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	16—17	..	6 3 6
100,000	10	,,	7½	Do. 7 p. c.	10	11½—12½	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 7
100,000	20	14 Dec.	8	Bahia, Limited	20	10—11	..	14 10 10
200,000	5	15 Nov.	6½	Bombay, Limited	5	5—5½	..	5 18 2
40,000	5	,,	6½	Do. New	4	3¾—4¼	..	6 2 6
380,000	Stck.	16 Aug.	11½	Brentford Consolidated	100	220—225	..	5 2 2
180,000	,,	,,	8½	Do. New	100	163—168	..	5 1 2
220,000	20	15 Sept	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	102—105	..	4 15 3
320,000	20	29 Sept.	11½	British	20	42—44	..	5 2 3
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5¾—6¼	..	3 1 6
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	98—101	..	5 18 10
150,000	20	13 July	8	Cagliari, Limited	20	27—28	..	5 14 3
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	244—249	..	5 0 4
165,000	,,	,,	9½	Do. New do.	100	187—192	..	4 19 0
160,762	,,	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	228—233	..	5 11 6
200,000	,,	,,	10	Do. 7 p. c. Pref	100	195—200	..	5 0 0
535,000	Stck.	15 Sept.	5	Crystal Palace Ord. 5 p.c. Stk	100	100—105	..	4 15 3
486,090	10	28 July	10	European, Limited	10	22—23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15—16	..	4 13 9
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	228—233	+2½	5 3 0
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	97—102	..	5 18 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	275—280	..	3 11 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	125—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	185—190	..	3 18 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	173—178	..	3 18 7
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	270—275	..	3 12 9
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	161—169	..	3 11 0
1,061,150	,,	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	210—215	..	5 11 7
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	106—108	..	4 12 7
541,920	20	15 Nov.	5	Monte Video, Limited	20	12¾—13¼	..	7 8 2
150,000	5	30 Nov.	8	Oriental, Limited	5	6¾—7¼	..	5 10 4
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4½	..	7 15 6
166,870	10	—	2	Pará Limited	10	1¾—1¾	..	—
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	98—102	..	5 17 8
500,000	100	1 Dec.	6	2nd Do.	100	96—100	..	6 0 0
150,000	10	13 Oct.	5	San Paulo, Limited	10	8¾—9¼	..	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	307—312	..	4 19 4
1,350,000	,,	,,	12	Do. B do.	100	243—248	..	4 16 10
260,000	,,	,,	13	Do. C do.	100	253—258	..	5 0 9
750,000	,,	13 July	5	Do. 5 p. c. Deb. Stk.	100	148—152	..	3 5 9
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	265–270*	..	3 14 1
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	208—213	..	3 15 1
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	143–148*	..	3 0 9
700,000	50	14 Dec.	8½	Grand Junction	50	109—112	..	3 15 10
708,000	Stck.	16 Aug.	11	Kent	100	285—290	..	3 15 10
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	235–240*	..	3 19 2
406,200	100	,,	7½	Do. 7½ p. c. max.	100	196–201*	..	3 14 9
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
500,000	100	16 Aug.	12½	New River, New Shares	100	345—350	..	3 9 3
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132—135	..	2 19 3
902,300	Stck.	14 Dec.	6	S'thwk & W'xnall, 10p. c. max.	100	155—160	+1½	3 15 0
126,500	100	,,	6	Do. D 7½ p. c. do.	100	144—148	..	4 1 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	263—267	..	3 14 10

*Ex div.

Companies Wound Up in the Past Year.—The total number of companies wound up last year in England and Wales was 1038, as compared with 1027 in 1892. They were divided as follows: Banking, 21; commercial, 778; and manufacturing, 239. Of the entire number, 145 were compulsory, and 893 voluntary. Adding 62 for Scotland and 28 for Ireland, makes the grand total 1128. Among them were the following: Wound up voluntarily: British Water-Gas Syndicate, Electric Supplies and Fittings Company, Guernsey Water-Works Company, London Lighting and Engineering Company, North British Water-Gas Syndicate, Yorkshire and Lancashire Water-Gas Company, Wenham Company. Wound up voluntarily with a view to reconstruction or amalgamation: Electric Construction Corporation, Uttoxeter Gaslight and Coke Company. Wound up by order of the Court: Woodhouse and Rawson.

The Water Clauses of the Thames Conservancy Bill.—Under the Bill deposited by the Thames Conservancy for the reconstruction of the Board, which is noticed in our article on "Water and Sanitary Affairs," the maximum quantities of water which the Water Companies under the Bill may take daily from the Thames, and the sums annually payable by them to the Conservators, are respectively as follows: Chelsea Water Company, 22,000,000 gallons and £4800; Lambeth Water Company, 24,500,000 gallons and £5450; Grand Junction Water Company, 24,500,000 gallons and £5500; Southwark and Vauxhall Water Company, 24,500,000 gallons and £5500; West Middlesex Water Company, 24,500,000 gallons and £5500; East London Water Company, 10,000,000 gallons and £3000; South-West Suburban Water Company, 1,000,000 gallons and £215; and West Surrey Water Company, 3,000,000 gallons and £150. The annual amount payable by the Companies to the Conservancy is increased to £30,115, and the quantity of water which may be taken by them daily in the aggregate is left at 134,000,000 gallons.

Staines and Egham Gas Company, Limited.—The annual meeting of this Company was held at the works on Thursday, the 21st ult., to receive and consider the Directors' report and statement of accounts, to determine the amount of dividend to be paid for the past year, for the election of Directors, and other business. A considerable number of shareholders attended—Mr. W. Weller being elected Chairman. A resolution was unanimously adopted approving the report and balance-sheet, which showed a very successful year's business; and it was resolved that the full statutory dividend of 12½ per cent. be paid. The three Directors retiring by rotation—viz., Messrs. R. Ashby, F. Ashby, and R. Winkworth—were re-elected. The Secretary (Mr. J. A. Engall), then explained that, as the real property would now be transferred to the Company under the Limited Liability Act, the present Trustees, who were *ex-officio* Directors, would cease to exist; and he suggested that the number of Directors should be made up to ten, as provided by the trust deed. Messrs. W. Weller, J. Harris, and F. W. Ashby were unanimously elected. Mr. R. Ashby said he had much pleasure in stating that the Directors had that day resolved to reduce the charge for gas by 2d. per 1000 feet; and from Jan. 1, 1894, it would be 3s. 4d. The meeting closed with votes of thanks.

The Contract for the Nidd Aqueduct.—A special meeting of the Contracts and Works Sub-Committee of the Bradford Corporation Water Committee was held last Thursday, for the purpose of considering the tenders for the construction of the Nidd aqueduct. There were 28 tenders, ten for the whole of the works, and the remainder for one or more of the six sections into which the works had been divided for the convenience of the smaller contractors. Eventually it was decided to let the whole of the work to Messrs. Morrison and Mason, of Glasgow, the contractors who are just completing the Thirlmere works for the Manchester Corporation. The tender is for the construction and maintenance for twelve months after completion of a main aqueduct from the River Nidd to Chellow Heights, Bradford, a distance of 31¼ miles or thereabouts; branch aqueducts extending to 5¾ miles or thereabouts in length, situated at various places on the line of the works; also dams, intakes, weirs, bridges, chambers, and other collateral works. The works comprise 5¾ miles of main aqueduct in tunnel; 11¾ miles of main aqueduct in cut-and-cover; 14 miles of main aqueduct trenches, and laying and jointing cast-iron and steel pipes, 36 inches in diameter; 5¾ miles of branch aqueducts and pipe-lines 30 inches to 6 inches in diameter; masonry dams and weirs at various streams; bridges over the River Wharfe, Leeds and Liverpool Canal, River Aire, and other streams; culvert under the Midland Railway, and steel girder bridge near Bolton Abbey Station; and measuring, air, scour, and other chambers. The Committee did not think it desirable to state publicly the amount of the tender.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

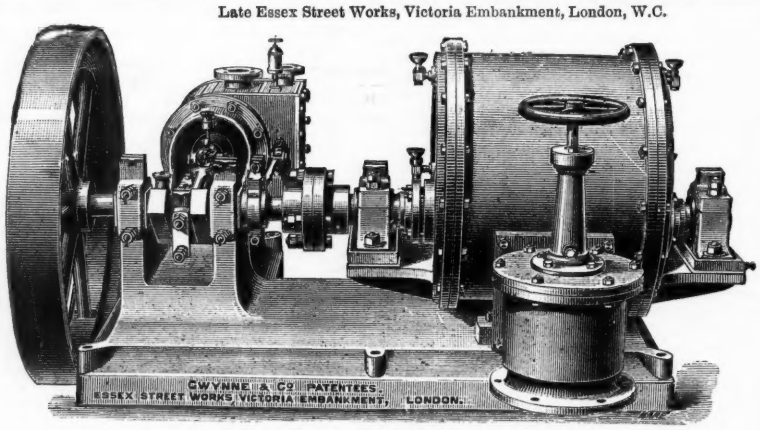
Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.

Late Essex Street Works, Victoria Embankment, London, W.C.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
ANDREW STEPHENSON, Sole Agent, 182, Gresham House, Old Broad Street, LONDON, E.C.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 45 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore, Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

LIQUOR, Tar, and Spent Oxide wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, BIRMINGHAM, LEE and WAKEFIELD.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See last week, p. 1157).
Telegrams: "HUTCHINSON BROS., BARNSLEY."

WANTED, a Situation as Gas Manager. Twelve years' experience as such. Highest references and testimonials as to character and ability.
Address No. 2319, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO ENGINEERS AND MANAGERS.

ADVERTISER is open to take, by contract or otherwise, RETORT WORK, BENCHES, and FURNACES—Regenerative or Generator. Having had 17 years' experience, he hopes to give every satisfaction in the coming season.
Address No. 2320, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a steady reliable Engine Man or NIGHT FOREMAN. To have charge of Boiler, Engine, Exhauster, Stokers, and Retort-House generally. Wages to commence at 35s. per week.
Apply, at once, by letter, stating age, experience, &c., to Mr. T. DUXBURY, Gas Manager, Middleton, near MANCHESTER.

MANAGER wanted by the Oil-Gas Enrichment Company, Limited. Must be a competent Gas Engineer, Correspondent, and Draughtsman.
Testimonial not necessary, but applicants to state shortly their experience, age, and salary expected.
Apply to the SECRETARY (J. Gordon Mason, S.S.C.), 28, Queen Street, EDINBURGH.

WANTED, immediately, a Man as MAIN and SERVICE LAYER, accustomed to fixing and reading of Meters and General Repairs on the Works.
Applications, stating age, qualifications, and salary required, with references, to be addressed to
T. SETTLE,
Manager.
Gas-Works, Knaresborough.

WANTED, a Working Foreman to assist the Manager at the Ashbourne Gas-Works. He must be thoroughly competent to take charge of the Works, able to do Main and Service Laying and Fitting. A steady sober Man a necessity.
Applicants should send particulars, stating previous experience and wages required, to
E. S. BRADLEY.
Ashbourne.

WANTED, immediately, an Accountant for a well-established Gas Company in Brazil. A knowledge of Portuguese will be an advantage. Engagement for Three Years.
Apply, by letter only, stating age (which must not exceed 28), salary required, if married or single, and how employed during the past five years, with copies only of three recent testimonials, to No. 2316, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Gas-Works making about 14 millions, two good steady STOKERS (4s. a shift), also a WORKING FOREMAN. Must be a good Carbonizer, and capable of doing all work required on a small Works. Sobriety and good character indispensable. Cottage, Coal, and Gas provided.
Address, stating experience and wages required, with recent characters, No. 2317, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

TO INVENTORS AND OTHERS.

PATENTS for Inventions Secured and TRADE MARKS REGISTERED throughout the World. Advice on all matters connected with the above. Handbook gratis on application.
J. C. CHAPMAN, C.E., Chartered Patent Agent, 70, Chancery Lane, LONDON.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

WANTED, a Working Manager, for the Marsden Local Board Gas-Works. He must have had experience, and possess a practical knowledge of the Manufacture of Gas. The production is about 11,000,000 feet of Gas per annum. Satisfactory references required as to character and ability.
Application to be sent by post on or before the 4th of January next, to Mr. JOE PINDER, Secretary of the Gas-Works, Marsden, near HUDDERSFIELD. On the envelope write "Gas Manager Application."

COUNTY BOROUGH OF HUDDERSFIELD.
(GAS DEPARTMENT)

DRAUGHTSMAN.

WANTED, at once (for about Twelve Months), a JUNIOR DRAUGHTSMAN. One who has had experience with a firm of Constructing Engineers will be preferred. Must be capable of making neat Tracings and detail Drawings. Salary, £75 per annum.
Applications, stating full particulars as to age, experience, and capabilities, accompanied by copies (on foolscap) of not more than three testimonials, to be delivered to Mr. W. R. Herring, Engineer, Gas-Works, Huddersfield, on or before the 8th of January next, endorsed "Draughtsman."
Canvassing of members of the Town Council will disqualify the candidate.
By order,
H. BARBER,
Town Clerk.
Town Hall, Huddersfield,
Dec. 27, 1893.

WANTED, to purchase, Gas Carbon, delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating price per ton and quantity, No. 2318, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WALTON-ON-THE-NAZE GAS-WORKS, ESSEX.

TO BE SOLD OR LET,

For Removal or Occupation, including the Mains as laid, and the convenient walled-in Yard, situated in Station Road.

THE Works may be viewed on application to the Foreman, James Francis, on the Premises; and, if satisfactory arrangements are effected, possession may be had early in January, 1894.
The Stock of Coals, Lime, Tubing, &c., to be taken at Valuation.
Offers to be addressed to the *pro tem.* Secretary of the Tendring Hundred Water-Works Company, 35, Bloomsbury Street, London, W.C.; but the Directors will not be bound to accept the highest or any Offer.
Dec. 1, 1893.

MR. M. L. ROSS begs to give Public Notice of the following fact: Having entered into a Contract with the Hydro-Oxy Oil Gas Proprietary of Sydney, Australia, through its Attorneys (George M. Light and H. M. Caldwell) at London, England, for the entire rights of the said Process under the Tatham Patents, in conjunction with all rights of the Brin's Oxygen Process, as per agreement between the Proprietary Company, for North and South America, Canada, and Mexico, excepting Rio Janeiro, ALL COMMUNICATIONS, APPLICATIONS, or INFORMATION NECESSARY OR DESIRED MUST BE ADDRESSED TO THE ABOVE up till Feb. 25, 1894, at the CONTINENTAL HOTEL, PARIS, and thereafter at the SAVOY HOTEL, NEW YORK.

I, the undersigned John Hall, do hereby UNRESERVEDLY WITHDRAW the STATEMENTS, CHARGES, and ACCUSATIONS made by me in a Letter written by me to the *Keighley News*, bearing date the 19th day of April, 1893, and published therein on the 22nd of that month, of and concerning Mr. JOHN LAYCOCK, the Manager of the Keighley Corporation Gas-Works, and admit such Statements, Charges, and Accusations to be False; and I hereby Apologize to Mr. John Laycock for having made them.
Dated this 25th day of November, 1893.
(Signed) JOHN HALL.
11, Alfred Street, Worth Village, Keighley.

THE Incandescent Gas-Light Company, Limited, whose Registered Office is at 14, Palmer Street, Westminster, give notice that they are prepared to commence immediate PROCEEDINGS against all Persons INFRINGING THEIR LETTERS PATENT, 1885, No. 15,286, granted to Carl Auer von Welsbach for the "Manufacture of an Illuminant Appliance for Gas and other Burners."
FAITHFULL AND OWEN, Solicitors.
11, Victoria Street, Westminster, S.W.

THE Deimel Light Company, Limited, of 86, Gray's Inn Road, London, E.C., give notice that they are DEFENDING PROCEEDINGS which have been instituted by the Incandescent Gas-Light Company, Limited, FOR ALLEGED INFRINGEMENT OF LETTERS PATENT, No. 15,286, of 1885, granted to Carl Auer Von Welsbach.
In such action the validity of the said Letters Patent will be contested.
STEADMAN, VAN PRAAGH, SONS, AND CO.,
Solicitors for the Deimel Light Company, Limited.
23, Old Broad Street, London, E.C.

WANTED, the Manufacturing of an Article in the Gas Trade by a Manufacturer of Sheet-Iron Ware in Germany.
Apply to Z.L. 1106, care of Samuel Deacon and Co., 150 and 154, Leadenhall Street, LONDON, E.C.

CORPORATION OF LEICESTER.

CAST-IRON PIPE CONTRACT.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply and delivery of the necessary CAST-IRON PIPES and CONNECTIONS, from 2 inches to 24 inches in diameter, required during the Twelve Months ending the 31st of December, 1894.
Specification and Form of Tender to be obtained from the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Cast-Iron Pipes, &c.," to be delivered at these Offices, not later than Eleven o'clock a.m., on Saturday, Jan. 6, 1894.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M.Inst. C.E.,
Engineer and Manager.
Gas Offices, Millstone Lane, Leicester,
Dec. 12, 1893.

CORPORATION OF LEICESTER.

RETORTS AND FIRE-BRICKS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply and delivery of RETORTS and FIRE-BRICKS.
Specification, Quantities, and Form of Tender can be obtained from the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Retorts, &c.," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, Jan. 6, 1894.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Gas Offices, Millstone Lane, Leicester,
Dec. 12, 1893.

Now Ready, Cloth Bound, Price 3s. 6d., Post Free,

THE ROYAL COMMISSION on the METROPOLITAN WATER SUPPLY.

— 1892-3. —

Report of the Evidence (reprinted from the JOURNAL), with Comments on the Inquiry, and the Commissioners' Conclusions and Recommendations.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

TO GAS AND WATER COMPANIES AND MANAGERS.

AN ASSOC.M.INST.C.E. having an extensive experience in GAS and WATER WORKS' DESIGN and ERECTION, now Chief Assistant in a large Gas-Works and Engineer to several small ones, having designed and erected a THREE HUNDRED and a ONE HUNDRED MILLION GAS-WORKS complete, besides several small ones, also ENLARGED many other Works, including NEW LIFTS to EXISTING GASHOLDERS, REGENERATIVE SETTINGS, &c., would be pleased to VISIT WORKS and ADVISE on their EXTENSION or ALTERATION, making SPECIFICATIONS, DRAWINGS, ESTIMATES, and superintend erection if desired.

SPECIALITIES.

Any EXTENSION or ALTERATION to GAS or WATER WORKS. ASSESSMENT of Gas-Works. New HOLDERS, TANKS, ROOFS, PURIFIERS, or FILTER-BEDS. TELESCOPING or adding FRESH LIFTS to EXISTING HOLDERS.
REGENERATIVE SETTINGS, for SMALL GAS-WORKS, without Excavations. SAVING 20 PER CENT. in first cost, renewals, and working.
Address "Boz," 9, Gracechurch Street, LONDON, E.C.

ROCHESTER, CHATHAM, AND STROOD GAS-LIGHT COMPANY.

THE Directors invite Tenders for the supply of One Hundred and Twenty 24-inch and Fifty 14-inch CAST-IRON SPIGOT AND SOCKET PIPES and sundry IRREGULARS, to be delivered during the month of March next.

Particulars and Forms of Tender may be obtained from the undersigned, to whom sealed tenders, endorsed "Cast-Iron Pipes," must be delivered on or before Noon, of Thursday, Jan. 11, 1894.

WILLIAM SYMS,
Secretary and Engineer.

Gas Offices, Rochester,
Dec. 16, 1893.

RETORTS AND FIRE-BRICKS.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company are prepared to receive TENDERS for the supply of about 2000 feet run of CLAY RETORTS, 11,000 FIRE-BRICKS, and 20 tons of CLAY, according to Specification and Form of Tender, which may be had on application at their Office, 58, High Street, Rochester, where tenders must be delivered before Noon of Thursday, the 11th of January, 1894.

WILLIAM SYMS,
Secretary and Engineer.

Dec. 28, 1893.

THE Knutsford Light and Water Company invite TENDERS for their production of AMMONIACAL LIQUOR for a period of One Year from the 1st of January, 1894.

The Company do not bind themselves to accept the highest or any tender.

Tenders to be sent in not later than the 10th of January to the Chairman of the Company.

FENTON URBAN SANITARY DISTRICT.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supp'y and delivery of 5000 tons of good GAS COAL or BURGY.

Form of Tender and Particulars may be obtained from the Manager.

Tenders to be sent in on or before Tuesday, the 23rd day of January, 1894, marked "Tender for Coal," addressed to the Chairman, Gas-Works, Fenton.

F. H. DARWIN,
Manager.

Gas Offices, Fenton, Dec. 13, 1893.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the supply of RETORTS and FIRE-BRICKS.

Specification, Quantities, and Form of Tender may be obtained upon application to Mr. W. Whatmough, Gas Manager.

Tenders, endorsed "Retorts and Fire-Bricks," to be sent to me not later than Tuesday, the 16th day of January, 1894.

By order,
A. B. PILLING,
Town Clerk.

Municipal Buildings, Heywood,
Dec. 29, 1893.

THE GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that the TRANSFER BOOKS of this Company, so far as they relate to Capital Stocks, WILL BE CLOSED at Four o'clock p.m., on Tuesday, the 9th day of January next, and will be re-opened immediately after the Half-Yearly General Meeting of the Company, to be held in the month of February next.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Dec. 30, 1893.

CASES FOR BINDING
VOLUMES OF THE "JOURNAL"
(GREEN CLOTH, GILT LETTERED)
Price 2s. each.

Price 2s. per dozen, or 10s. 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,
(Established 1851,)
Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.
SCULCOATS HULL.

HUNTER'S
OXIDE OF IRON.
JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER PORT GLASGOW."
Established 1872.

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

NOW READY,

The Gas Engineer's Annual

and World's Directory of Gas Companies for 1894.

CONTAINING TWELVE SPECIAL ARTICLES ON IMPORTANT GAS SUBJECTS;

ALSO THE FOLLOWING INDISPENSABLE INFORMATION:

ASSOCIATIONS OF GAS MANAGERS in Great Britain; **DIRECTORY OF GAS COMPANIES** of Great Britain and Ireland, with their Annual Make of Gas, Coal Carbonized, and other Statistics; **CONTINENTAL AND FOREIGN GAS COMPANIES; ASSOCIATIONS OF EUROPEAN GAS COMPANIES; DIRECTORY OF CONTINENTAL, COLONIAL, AND FOREIGN GAS COMPANIES.**

Price 5s., post free; or with DIARY, 7s. 6d.

Publishers: J. G. HAMMOND & CO., Limited, Moor Street, BIRMINGHAM.

UNSOLICITED TESTIMONIAL.

From the INDIAN GENERAL GAS COMPANY, No. 4, Ram Mohun, Ghose's Lane, Calcutta, Oct. 8, 1890.

DEAR SIRS,—I have pleasure to inform you that your "Gas Companies' Annual and Directory," and "Gas Engineer's Diary," are most useful to Gas Engineers and Managers; and I find it necessary to become a subscriber for each year.

Yours faithfully, C. K. SHAW, Manager.

NOW READY. PRICE 2s. 6d., POST FREE; or with GAS ENGINEER'S ANNUAL, 7s. 6d.

The Gas Engineer's Diary for 1894,

Containing all kinds of Statistical and Other Information useful to Gas Engineers and Managers:

Weights of 9-feet Lengths of Cast-Iron Pipes of various Diameters. Relative Values of Illuminating Agents. Comparison of the Price of Gas in English and French Measures. Ingredients of Coal. New Standard Wire Gauge. Station Meters. Dimensions of Service-Pipes. Specific Heats of Different Bodies. Table, showing the proportion of Hydrogen and Carbon in Coal Gas distilled at different Temperatures. Specific Gravities of Liquids. Conducting Power of Metals. Weight and Pressure of Gasholders. Areas and Circumferences of Circles from 1 to 99 feet. Weight of a Lineal Foot of Round and Square Bar-Iron in pounds. Weight of Lead and Composition Gas-Pipes. Weight of a Square Foot of Sheet Metal in pounds—Thickness Birmingham Wire Gauge. Price List of Wrought-Iron Tubes. Yield of Gas.

Diary Section for each Day of the Year as follows (Two Days on a Page). Daily Specimen.

Date.	Sun Rises.	Sun Sets.	Moon Rises.	Moon Sets.	Coals Used.	Cannel Used.	Lime Received.	Meter-Index.	Retorts in Use.	Gas made in 24 Hours.	Gas Sent Out.	Coke Sold.	Illuminating Power.
	H. M.	H. M.	H. M.	H. M.	Tons.	Tons.	Tons.			Cub. Ft.	Cub. Ft.	Tons.	Candles.
JANUARY.													
1—MONDAY	8 8	3 59	2 27	7 24									
SAME DATE, 1893.													

At the End of each Week, a Weekly Summary is given.

Retort Account; Purifier-House Memoranda; Monthly Return, showing number of Mouthpieces at work, Wages paid, &c.; **Additional Mains Laid,** with Columns for Date, Size, Length, &c.; **New and Renewed Services.**

Publishers: J. G. HAMMOND & CO., Limited, Moor Street, BIRMINGHAM.

UNSOLICITED TESTIMONIAL.

To J. G. HAMMOND & CO., LIMITED, Birmingham.

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NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

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NEWBATTLE COLLIERIES,

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UNEQUALLED.

Gas Companies are solicited to try Samples of the

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BLACK BED GAS COAL.

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RAVENSTHORPE, NEAR DEWSBURY.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

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COAL OWNERS, NEWCASTLE-ON-TYNE;

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HOLMSIDE GAS COALS.

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PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

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For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

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JAMES WHITE & Co., Limited,

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MEIKLEJOHN'S PATENT

Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
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THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

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QUAYSIDE, NEWCASTLE-ON-TYNE.

TROTTER, HAINES, & CORBETT,

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

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SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers and rendering leakage impossible.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON, FITTER.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton	10,500 cubic feet.
Illuminating Power	16·4 candles.
Coke	68 per cent.

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Established 1858. The First Manufactory of Silica and Dinas Fire-Bricks erected in England.

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Specially adapted for Siemens-Martin Gas-Furnaces; also for Gas, Copper, Iron, Steel, and other Furnaces where intense heat is required.

BESSEMER GANNISTER, STEEL-FURNACE GANNISTER, COPPER-FURNACE GANNISTER, IRONFOUNDERS' CUPOLA SAND, FINE-SETTING SILICA CEMENT, STEEL MOULDERS' COMPOSITION.

Our Silica Bricks have gained a high reputation for Unsurpassed Quality in most of the leading Firms in England and on the Continent. Export orders delivered Liverpool, Hull, Grimsby, or the Tyne.

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FOR LARGE OR SMALL
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FOR THE ERECTION OF GAS AND WATER WORKS COMPLETE, AND FOR EXTENSIONS AND RENEWALS.

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The cheapest, and most simple
The most economic, and most durable
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And the most easily cleaned
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HAS BEEN AWARDED 8 GOLD AND SILVER MEDALS.

FOR INDOOR AND OUTDOOR LIGHTING.

"The Meteor," being made entirely of fine cast iron, is practically indestructible.

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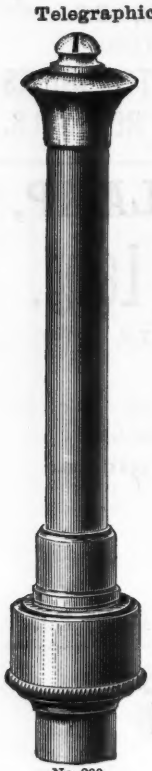

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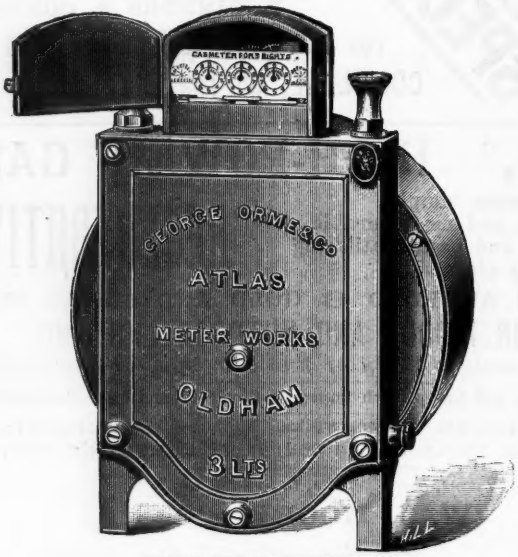

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ORME'S GAS REGULATOR FOR STREET LAMPS.

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Adopted by the leading London and Provincial Gas Companies. More than 150,000 now in use.

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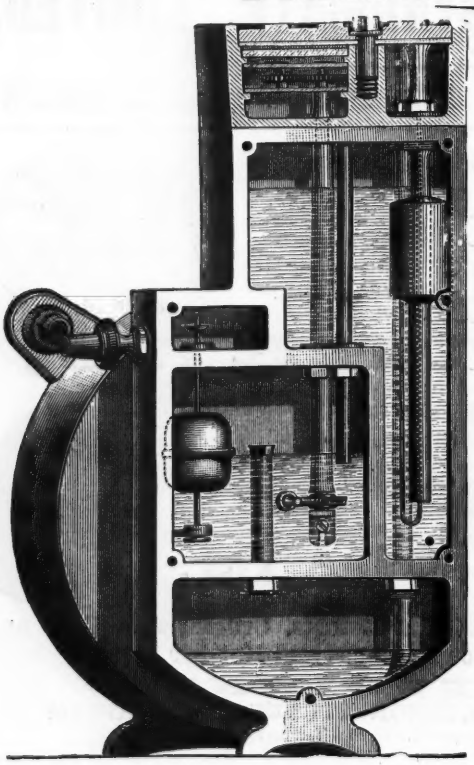
IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.



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UNDERGROUND METER

Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost. No box is required, and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s., and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 3½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid, which does not injure the fittings; and this can be supplied at about 1s. 3d. per gallon.

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SOLE PROPRIETORS OF

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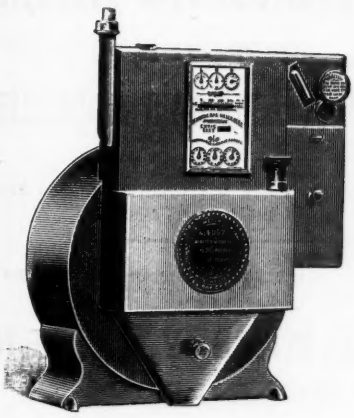

The amount of Gas given in exchange for Coin can be altered *in Situ.*

The amount of Cash placed in the Box is recorded; and this is a complete check against fraud.

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Retort-Fittings.
Scrubbers, Purifiers, Tanks } with planed joints,
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Columns and Beams,
Separators for Tar,
Gas-Valves,
Centre-Valves to work four Boxes at one time,
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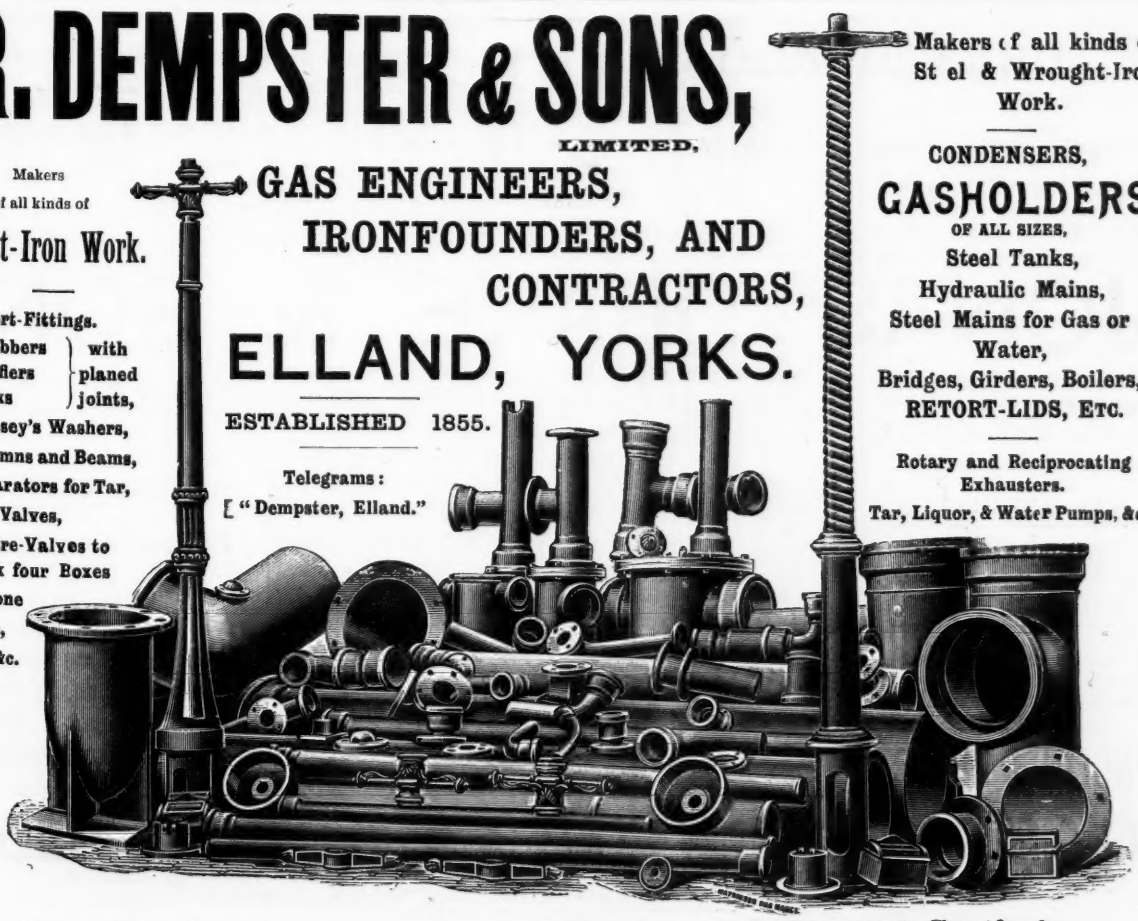

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OF ALL SIZES,
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Rotary and Reciprocating Exhausters.
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Special Connections, Lamp Columns, and General Castings.

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Late General Inspector,
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Contracting Engineers for Water Gas Plant,
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Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS,
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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GAS AND WATER PIPES
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CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE
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IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

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The Apparatus has been supplied to the following Firms—

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ANIMAL CHARCOAL CO., Limited, SHADWELL.
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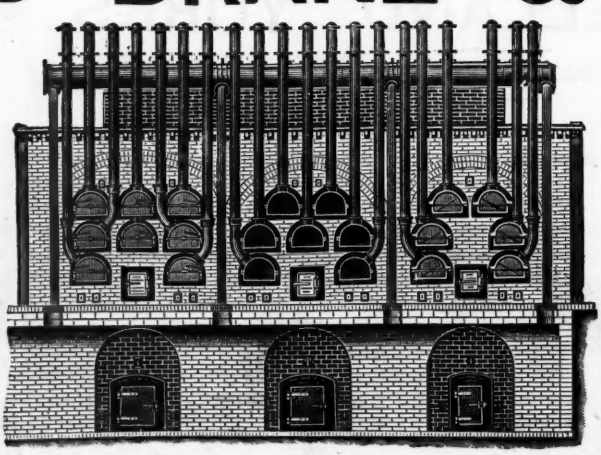
BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



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REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S, VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

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IRISH OXIDE OF IRON.

GAS PURIFICATION.

RIKY'S OXIDE (formerly worked by Messrs. Stanley and Olphert).

THE LARGEST SUPPLY OF OXIDE IN HAND OF ANY OTHER FIRM IN THE WORLD.

Purity and Uniformity of Quality Guaranteed.

RIKY AND CO. can supply the above at a much lower rate than any other firm in the trade, being owners of the property where it is found. *No Middleman* or *Agent* receives a profit.

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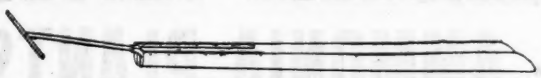
STEEL SCOOPS FOR RETORT CHARGING.



Scoops supplied with or without handles, and of any dimensions or shape required.

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MAKE

RETORT LIDS

OF ALL FORMS AND SHAPES IN IRON OR STEEL

BY SPECIAL HYDRAULIC MACHINERY.

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IMPORTANT TO ENGINEERS AND GAS COMPANIES.

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FOR PRICES AND FULL PARTICULARS, APPLY TO

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W. C. HOLMES & Co.,

Purifier-Houses, with Overhead Water-Tank, also Scrubber, in course of construction by us for the Huddersfield Corporation, From Designs by Mr. W. R. Herring.

Makers also of Retort Ironwork, Condensers, Patent Scrubber-Washers, Gasholders of all sizes, and Gas Plant of every description.

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R. & J. DEMPSTER,

GAS PLANT WORKS, Limited,

NEWTON HEATH, MANCHESTER.

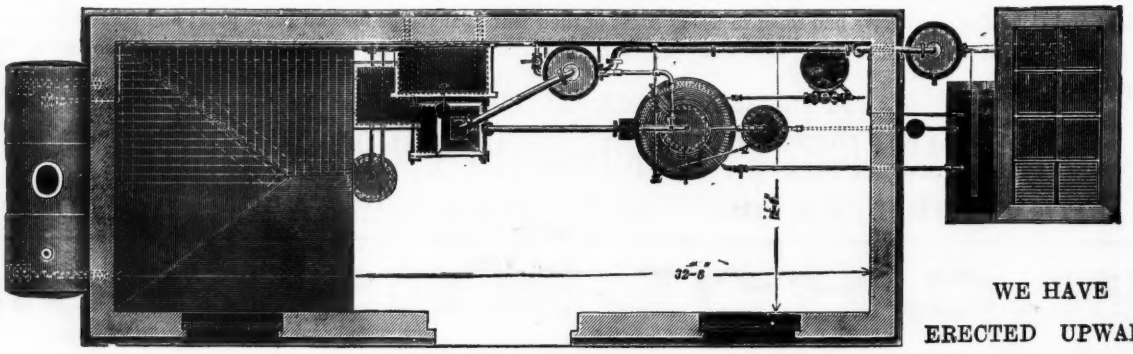
PATENT SULPHATE OF AMMONIA PLANTS

FOR PRODUCING WHITE SALTS FROM PYRITES ACID.

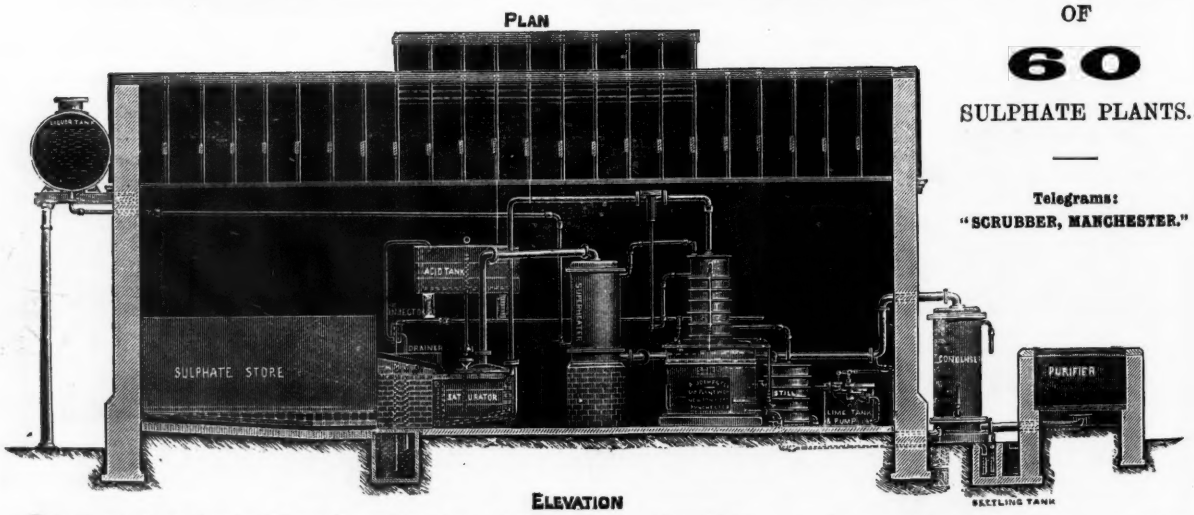
"Splendid Results"—32 lbs. of Sulphate per ton of Coal.

(See "Register of Patents," JOURNAL OF GAS LIGHTING for Nov. 14, 1893.)

In addition to a number of these Plants already at work, FIVE complete Plants are on order for early completion.



PLAN



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WE HAVE ERECTED UPWARDS OF

60

SULPHATE PLANTS.

Telegrams: "SCRUBBER, MANCHESTER."

Our recent Patents have brought the Stills used in these Plants to the highest state of perfection; and they are superior to any in the market. They are so constructed that the trays or compartments may be easily cleaned, and, if necessary, the hoods removed, without taking the Still to pieces. A large quantity of Liquor can be worked off quickly without loss of Ammonia. Very little Steam is required; and the Plants may be worked continuously or let down at night. They occupy little space, and are worked without any danger to the attendant. The first cost is small; and in construction they are strong and durable. They are approved by the Government Inspectors, and guaranteed not to cause any nuisance.

We can adapt our Improved Patent Stills to work with existing apparatus at small outlay, compared with the increased production of Sulphate.

ESTIMATES AND ILLUSTRATIONS ON APPLICATION.

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BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1836.

HENRY BALFOUR & CO.,
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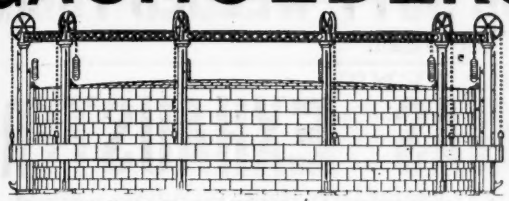
MAKERS OF
GASHOLDERS



PRESSURE-REGULATORS FOR GASHOLDERS (See "JOURNAL" Dec. 20 1892.)
FOUR-WAY VALVES,
AND ALL CLASSES OF GAS APPARATUS.
HENRY PUPLETT, 47, Victoria Street, S.W.

The Climax of Regenerative Gas Lighting!!

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"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
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PARTICULARS AND PRICES FREE. AGENTS WANTED.

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Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.
RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
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SUPPLY FROM STOCK
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SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
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Absolutely the Cheapest, Simplest, and most Economical Lamp before the Public.

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Suitable for Suspension, or can be fixed to the ordinary Bracket in place of Burner.

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Consumption 6 and 9½ cubic feet respectively.

Proprietors: THE DEIMEL LIGHT COMPANY, LIMITED,
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J. & W. HORTON
ETNA WORKS,
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IMPROVED GASHOLDERS AND BOILERS

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Cast and Wrought Iron Tanks, Purifiers, Condensers, Scrubbers, Retort-Lids, Cross-Bars and Screws, Wrought-Iron Boilers for Stationary, Portable, and Marine Engines, Sugar Pans, Coolers, Clarifiers, Punts, Boats, Bridges, Girders, Roofs, Cisterns, Oil-Tanks, Melting-Pots, Crucibles, Salt-Pans, Arch and Range Boilers, and every description of General Ironwork.

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MANUFACTURERS OF EVERY DESCRIPTION OF

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FOR ANY PURPOSE.

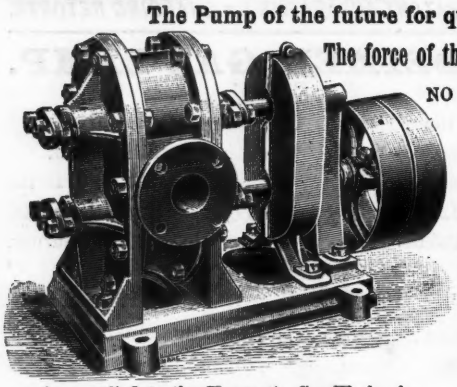
JOHNSON'S PATENT

DRUM PUMP AND GAS EXHAUSTER.

The Pump of the future for quickly and economically moving large bodies of Water.

The force of the Piston Pump with the capacity of the Centrifugal combined.

NO SLIDES OR FRICTIONAL WORKING PARTS.



As supplied to the Harrogate Gas-Works for Pumping Gas Liquor.

NO PRIMING.

NO VALVES.

As supplied to H.R.H. the Prince of Wales for Pumping Gas Liquor at his Sandringham Gas-Works.

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ESTABLISHED 1837.

The most efficient Machine known for extracting Ammonia and other Impurities from Coal Gas is

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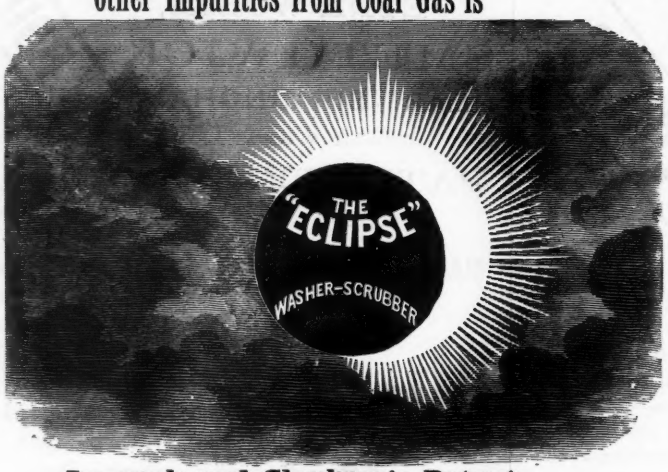
WELLINGTON, NELSON, & MARKET ST. WORKS.
Telephone No. 2235,
Telegraphic Address: "CLAPHAM BROTHERS Keighley."



Laycock and Clapham's Patent.

The Patent Wooden Balls thoroughly break up the Gas; give an immense amount of freshly-wetted Surface; and do not clog or increase back pressure.

Whilst the Gas is passing through and amongst the Balls, it is continually showered upon by the contents of Buckets.

The Shaft Revolves in Improved Bearings, and all Workings are accessible.

REPAIRS AND TROUBLE REDUCED TO A MINIMUM.

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